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Burlington Environmental Pier 91

8A - RFI Workplans / Background Reports

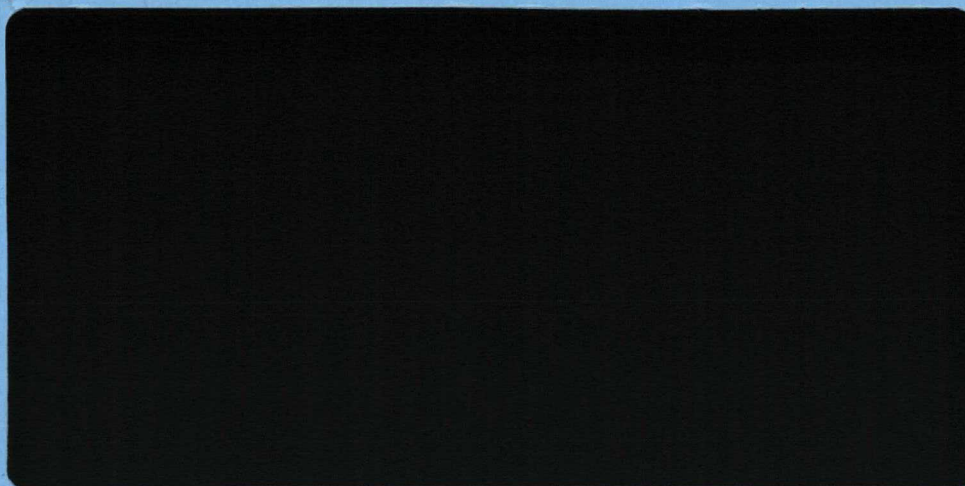


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September 4, 1990

Dave Croxton
US EPA Region X
1200 Sixth Avenue
Seattle, WA 98101

RE: Chemical Processors, Inc. Pier 91 Facility
Draft RFI Workplan (3008 (h) Order)

Dear Mr. Croxton:

Please find enclosed 2 copies of the Draft RFI Workplan for the Pier 91 Facility. If you have questions, please contact me at (206) 223-0500.

Sincerely,

Susan B. Donahue
Compliance Manager

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cc: Barb Smith, Ecology NWRO
Dave Aggerholm, Port of Seattle

CHEMICAL PROCESSORS, INC.

2203 Airport Way South . Suite 400 • Seattle, Washington 98134
(206) 223-0500 • FAX: 223-7791

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**DRAFT WORK PLAN
CHEMPRO PIER 91
RCRA FACILITY INVESTIGATION
Seattle, Washington**

September 4, 1990

WA 2917

Prepared for

Chemical Processors, Inc.
2203 Airport Way South, Suite 400
Seattle, Washington 98134

Submitted to

U.S. Environmental Protection Agency
Region X
Seattle, Washington

Prepared by

Sweet-Edwards/EMCON, Inc.
18912 North Creek Parkway, Suite 210
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Project No. S94-07.05

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CONTENTS

Tables And Figures	vii
Preface	ix
PART A - FACILITY ENVIRONMENTAL BACKGROUND	
1 Site Description And History	A-2
2 Facility Setting	A-5
3 Previous Studies	A-8
4 Findings Of Previous Studies	A-9
4.1 Site Geology and Hydrogeology	A-9
4.2 Site Geochemistry	A-10
4.3 Site Hydrochemistry	A-12
4.4 General Conclusions	A-13
4.5 Preliminary Pathways Analysis	A-13
PART B - PRELIMINARY TECHNOLOGIES EVALUATION	
PART C - SAMPLING PLAN	
1 Introduction	C-2
1.1 Objectives	C-2
1.2 Investigation Approach/Summary of Work Scope	C-2
1.3 Project Schedule	C-7
1.4 Site Access	C-7
1.5 Limitations	C-7
2 Historical Site Evaluation	C-8
3 Beneficial Use Survey	C-9
4 Site Safety	C-10

CONTENTS (Continued)

5 Decontamination Procedures	C-11
6 Residuals Management	C-12
7 Drilling And Soil Sampling	C-13
7.1 Drilling Procedures	C-13
7.2 Soil Chemical Analysis	C-14
7.3 Soil Sampling Procedures	C-14
8 Monitoring Wells	C-22
8.1 Installation Procedures	C-22
8.2 Well Development	C-25
8.3 Surveying	C-25
9 Water Sampling And Analysis	C-26
9.1 Water Sampling Procedures	C-26
9.2 Water Chemical Analysis	C-28
10 Sample Labeling, Shipping, And Chain-of-Custody	C-30
10.1 Sample Labeling	C-30
10.2 Sample Shipping	C-30
10.3 Chain-of-Custody	C-32
11 Water Level Measurements	C-33
12 Hydraulic Conductivity Testing	C-34
PART D - RISK ASSESSMENT	
1 Purpose	D-2
2 Hazard Evaluation	D-3

CONTENTS (Continued)

3 Toxicity Assessment	D-4
4 Exposure Assessment	D-6
5 Risk Characterization	D-8
6 Environmental Evaluation	D-9
7 Uncertainty Analysis	D-10
8 Report	D-11

PART E - PROJECT DELIVERABLES AND SCHEDULE

1. Deliverables and Schedule	E-2
1.1 Deliverables	E-2
1.2 Schedule	E-2

PART F - QUALITY ASSURANCE PROJECT PLAN/DATA MANAGEMENT PLAN

1 Introduction	F-3
2 Project Description	F-4
3 Project Organization And Responsibilities	F-5
4 Objectives For Measurement	F-8
5 Sampling Procedures	F-11

CONTENTS (Continued)

6 Sample Custody	F-14
6.1 Field Sampling Operations	F-14
6.2 Shipping	F-15
6.3 Laboratory	F-15
7 Calibration Procedures And Frequency	F-17
8 Analytical Procedures	F-18
9 Internal Quality Control Checks	F-19
10 Performance and System Audits	F-20
11 Preventive Maintenance	F-21
12 Data Precision, Accuracy, And Completeness	F-22
13 Corrective Actions	F-25
14 Quality Assurance Reports	F-26
15 Data Management	F-27
15.1 Field Data	F-27
15.2 Laboratory Data	F-28
15.3 Data Validation	F-28
15.4 Data Base Management	F-32
 PART G - HEALTH AND SAFETY PLAN	
1 Purpose	G-1
2 Key Management/Health And Safety Personnel	G-3

CONTENTS (Continued)

3 Field Investigation	G-4
3.1 Scope of Work	G-4
3.2 Site Control	G-4
3.3 Hazards	G-6
3.4 Levels of Protection and Safety Equipment	G-15
3.5 Field Monitoring Requirements	G-15
3.6 Decontamination	G-17
4 Training And Medical Monitoring Requirements	G-20
4.1 Training Requirements	G-20
4.2 Medical Monitoring Requirements	G-21
5 Emergency Planning	G-22
5.1 Emergency Communications Protocol	G-23
5.2 Injury or Exposure	G-23
6 Emergency Contacts	G-24
Appendix G-1 Hazardous Materials Information	
Appendix G-2 Instrument Instructions	
Appendix G-3 Site Safety Plan Consent Agreement	
PART H - COMMUNITY RELATIONS PLAN	
1 Introduction	H-2
1.1 Overview of the Community Relations Plan	H-2
1.2 Capsule Site Description	H-2
2 Community Relations	H-4
2.1 Community Background	H-4

CONTENTS (Continued)

2.2	Highlights of the Community Relations Program	H-4
2.3	Community Relations Activities and Timing	H-5

Appendix H-1 Contact List Of Key Community Leaders And Interested Parties

PART I - REFERENCES

TABLES AND FIGURES

Tables

Table A-1	Chempro Pier 91 Pathways Analysis	A-15
Table C-1	Summary of Site Selection Criteria	C-5
Table C-2	Summary of Soil Samples for Testing	C-15
Table C-3	Summary of Sample Testing	C-17
Table C-4	Sampling Parameters and Laboratory Methodology	C-19
Table C-5	Summary of Water Samples and Analysis	C-29
Table F-1	Personnel Responsibilities for Quality Assurance	F-7
Table F-2	Objectives for Measurement Data	F-9
Table F-3	Recommended Quantitation Limits	F-10
Table F-4	Sample Containers, Preparation, and Preservatives	F-12
Table F-5	Recommended Documentation for Independent QA Review of Data on Organic Substances	F-29
Table F-6	Recommended Documentation for Independent QA Review of Data on Inorganic Substances	F-31
Table G-1	Health Exposure Summary	G-7
Table G-2	Required Protective Clothing and Safety Equipment	G-11
Table G-3	Decision Criteria for Upgrading of Personal Protective Clothing	G-13
Table G-4	Decontamination Procedures	G-18

Figures

Figure A-1	Site Location Map	A-3
Figure A-2	Site Physiographic Map	A-6
Figure A-3	Site Map	A-7
Figure A-4	Sources in Pathways Analysis	A-14
Figure C-1	Boring and Monitoring Well Locations	C-4
Figure C-2	Typical Monitoring Well Completion	C-23
Figure F-1	Organization Flow Chart	F-6
Figure F-2	Field Sampling Data Sheet	F-13
Figure F-3	Chain-of-Custody/Analysis Request Form	F-16
Figure G-1	Site Location Map	G-2
Figure G-2	Facility Map	G-5

PREFACE

This document outlines the proposed studies to be performed as part of the RCRA Facility Investigation (RFI) at the Chemical Processors, Inc. (Chempro) Pier 91 facility in Seattle, Washington. The scope of work proposed in this document has been prepared to meet the 3008(h) Agreed Order issued by the U.S. Environmental Protection Agency (EPA) Region X (1089-11-06-3008h).

This document has been organized into the following eight parts:

- **Part A** - Facility Environmental Background

The Facility Environmental Background includes site background and history, findings of previous studies, and a preliminary analysis of possible pathways of potential contaminants originating from the facility to the environment. The preliminary pathways analysis is used in part to identify where additional sampling data are required.

- **Part B** - Preliminary Technologies Evaluation

The Preliminary Technologies Evaluation summarizes an initial review of remedial technologies that may be applicable to this facility.

- **Part C** - Sampling Plan

The Sampling Plan includes the objectives of the investigation, a summary of the work scope, and a detailed description of the technical tasks (beneficial use survey, drilling, soil sampling, monitoring well installation, ground water sampling, and hydraulic conductivity testing).

- **Part D** - Risk Assessment

The Risk Assessment includes the tasks to be conducted to determine human health and environmental risk.

- **Part E - Schedule**

The Project Schedule identifies the technical tasks, field tasks, submittals to EPA, status reports, and review schedule.

- **Part F - Quality Assurance Project Plan**

The Quality Assurance Project Plan identifies the sampling methods, sampling equipment, analytical methods, and QA/QC requirements.

- **Part G - Site Safety Plan**

The Site Safety Plan identifies the health and safety requirements for the investigation including training, personal protection, decontamination, and hazard information.

- **Part H - Community Relations Plan**

The community Relations Plan identifies the procedures that will be followed to disseminate information to the community concerning the progress of the RFI.

PART A

FACILITY ENVIRONMENTAL BACKGROUND

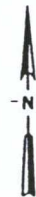
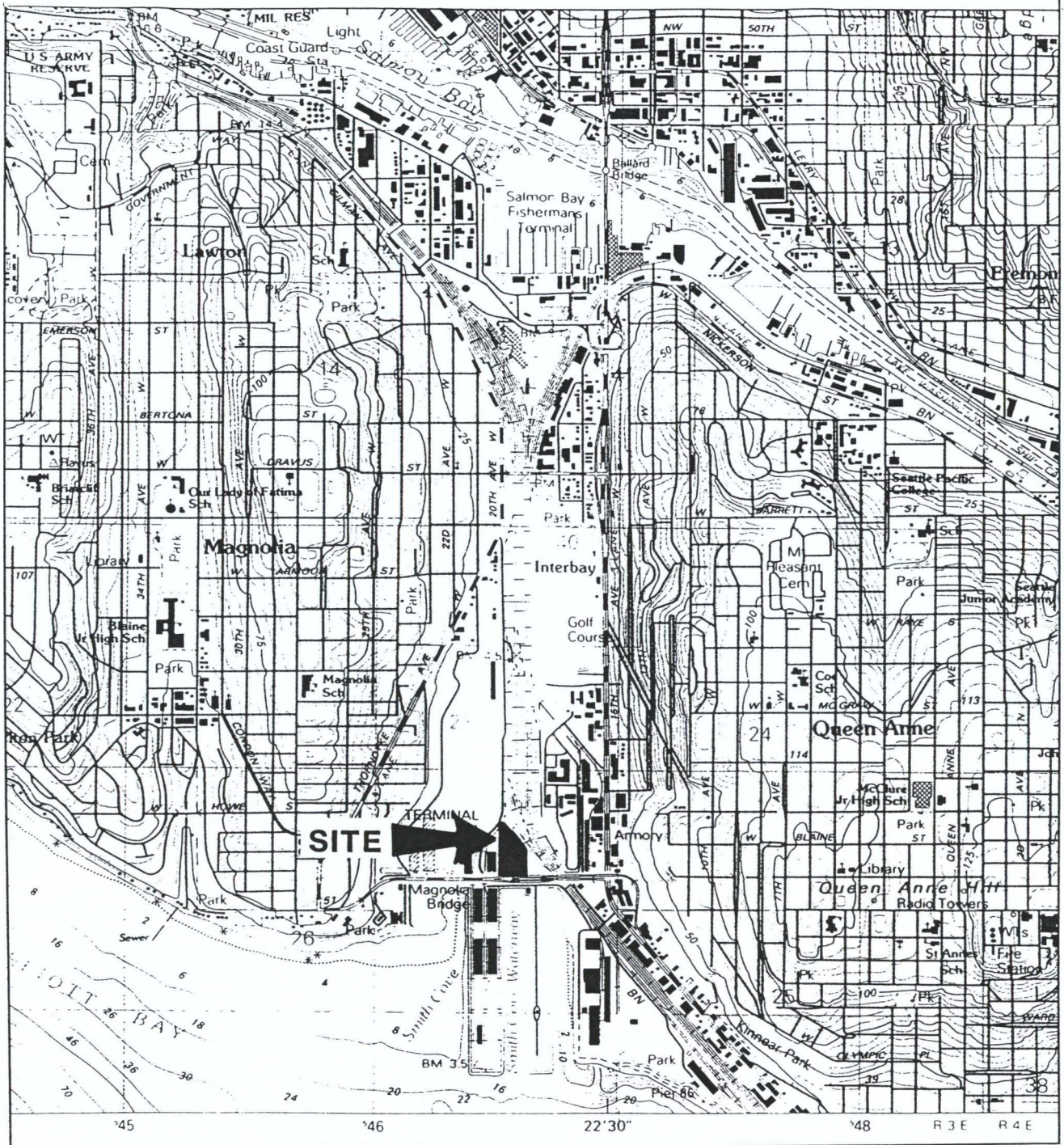
1 SITE DESCRIPTION AND HISTORY

Chemical Processor's Pier 91 facility is located at 2001 West Garfield Street, Seattle, Washington (Figure A-1). Facility operations currently include waste oil recycling and treatment. The tank system currently leased by Chemical Processors, Inc. was first constructed in approximately 1926, for use as a gasoline refinery by the California Petroleum Company. The tank system property was owned and/or operated by the California Petroleum Company and subsequent oil companies; surrounding land and piers were owned and/or operated by the Port of Seattle. The duration of California Petroleum Company's operations is unknown. A January 1931 archive drawing indicates that the Port of Seattle Commission was the owner/operator of the tank system at that time.

In December 1941, the U.S. Navy took possession of the tank system and all surrounding Port of Seattle property, including Piers 90 and 91. The area was used by the Navy as a major shipping and staging point during World War II, the Korean War, and the Vietnam War. Buildings constructed in the area included warehouses, refrigeration facilities, barracks, and other support facilities. The tank system was used primarily as a fuel and lubricating oil transfer station. The Navy maintained possession of Pier 91 until the early 1970s. During the time of Navy ownership, the area was also used by the U.S. coast Guard and the National Oceanic and Atmospheric Administration (NOAA).

In approximately 1972, the Port of Seattle began managing a marine cargo facility in the area. The property was reacquired by the Port of Seattle in 1976, and has remained under its management since that time.

Chemical Processors, Inc. leased the tank system property in June 1971. The facility's first shipment was received in September 1971, and consisted of waste oil to be recovered for use as industrial fuel. Since operations began in 1971, the Pier 91 facility's main activities have been waste oil recovery and wastewater treatment. Typical waste streams processed at Pier 91 facility include oil and coolant emulsions, industrial wastewater, and industrial waste sludges.



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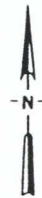
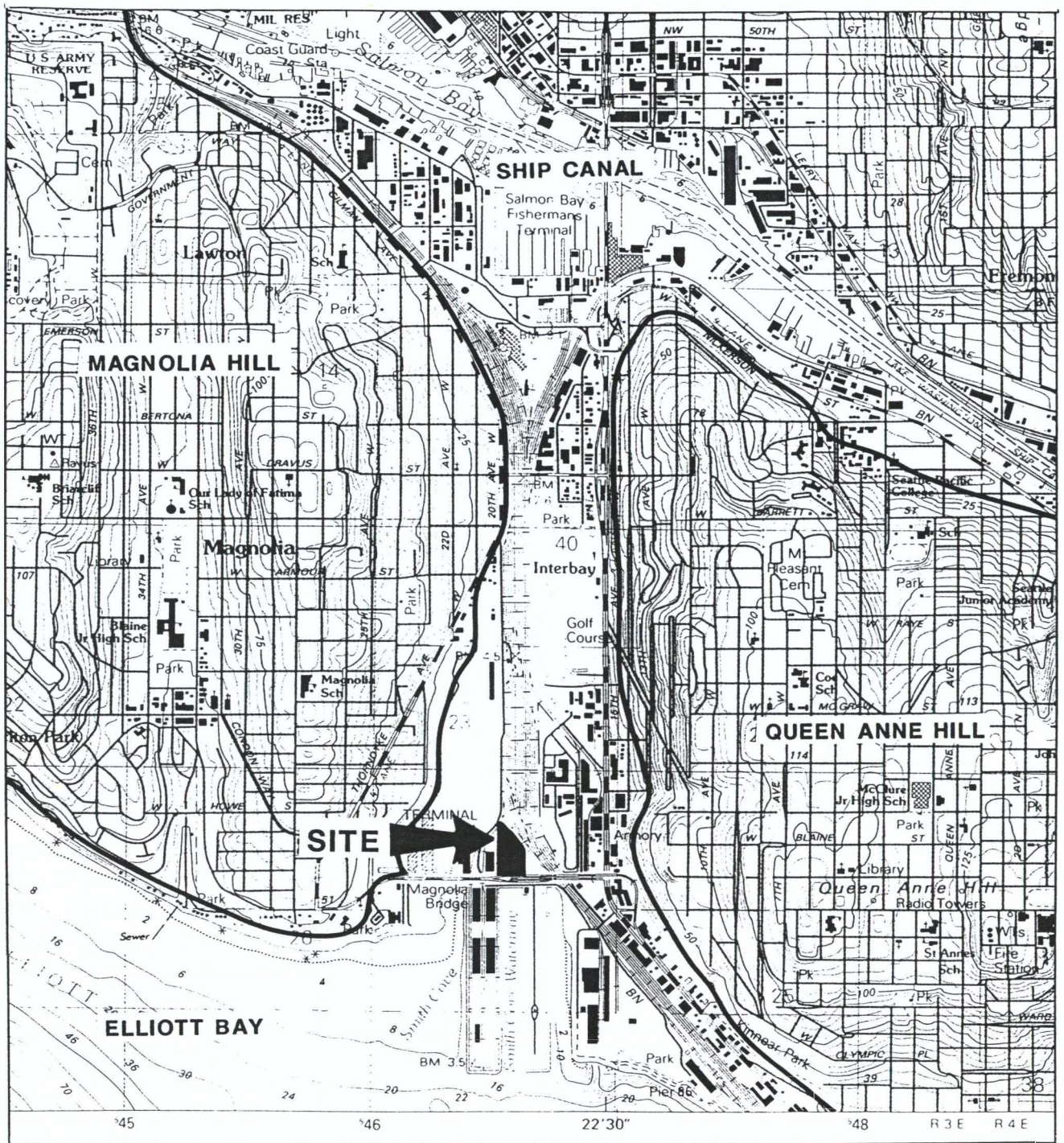
Figure A-1
CHEMPRO PIER 91 FACILITY
SITE LOCATION MAP

2 FACILITY SETTING

The Chempro facility is a flat lying site, located in a topographic low with Queen Anne Hill to the east, Magnolia Hill on the west, and Elliott Bay to the south (Figure A-2). The ground surface at the facility is covered by either asphalt or concrete. The tank farm is divided into three areas (Figure A-3), the southern two of which are completely surrounded by a product-containment wall about 15 feet high. Both above-ground and subsurface piping systems crisscross the site.

Seattle lies within a physiographic region referred to as the Puget Sound Lowland, a topographic and structural basin bordered by the Cascade Range on the east and the Olympic Mountains on the west. The basin is underlain by up to 1,000 feet of unconsolidated glacial and non-glacial sediments (Liesch, et al, 1963). Pier 91 site lies within a lowland area that has resulted from glacial and/or post glacial downcutting. This lowland feature extends from the ship canal on the north to Elliott Bay on the south, is 1.5 miles in length, and has a width of approximately 1,000 to 2,000 feet. Fill has been added over a large portion of the lowland area. The Pier 91 facility is believed to overlie a portion of the "Smith's Cove" inlet, modified by fill in the early 1900s.

Ground water flow within the Puget Sound Lowland can be divided into regional, intermediate, and local flow systems. The regional flow systems represent the deepest and longest flowpaths, recharged in the Cascade Mountains and adjacent foothills and discharging to the lower floodplains and terraces of Puget Sound. Intermediate flow systems lie between the two extremes represented by regional and local systems. Local flow systems represent the shallowest and shortest flowpaths, both recharged in and discharging in the same basin. Topography and geology strongly control local flow. In general, local flow in the vicinity of the Pier 91 site is presumed to be from topographic high points towards Puget Sound.



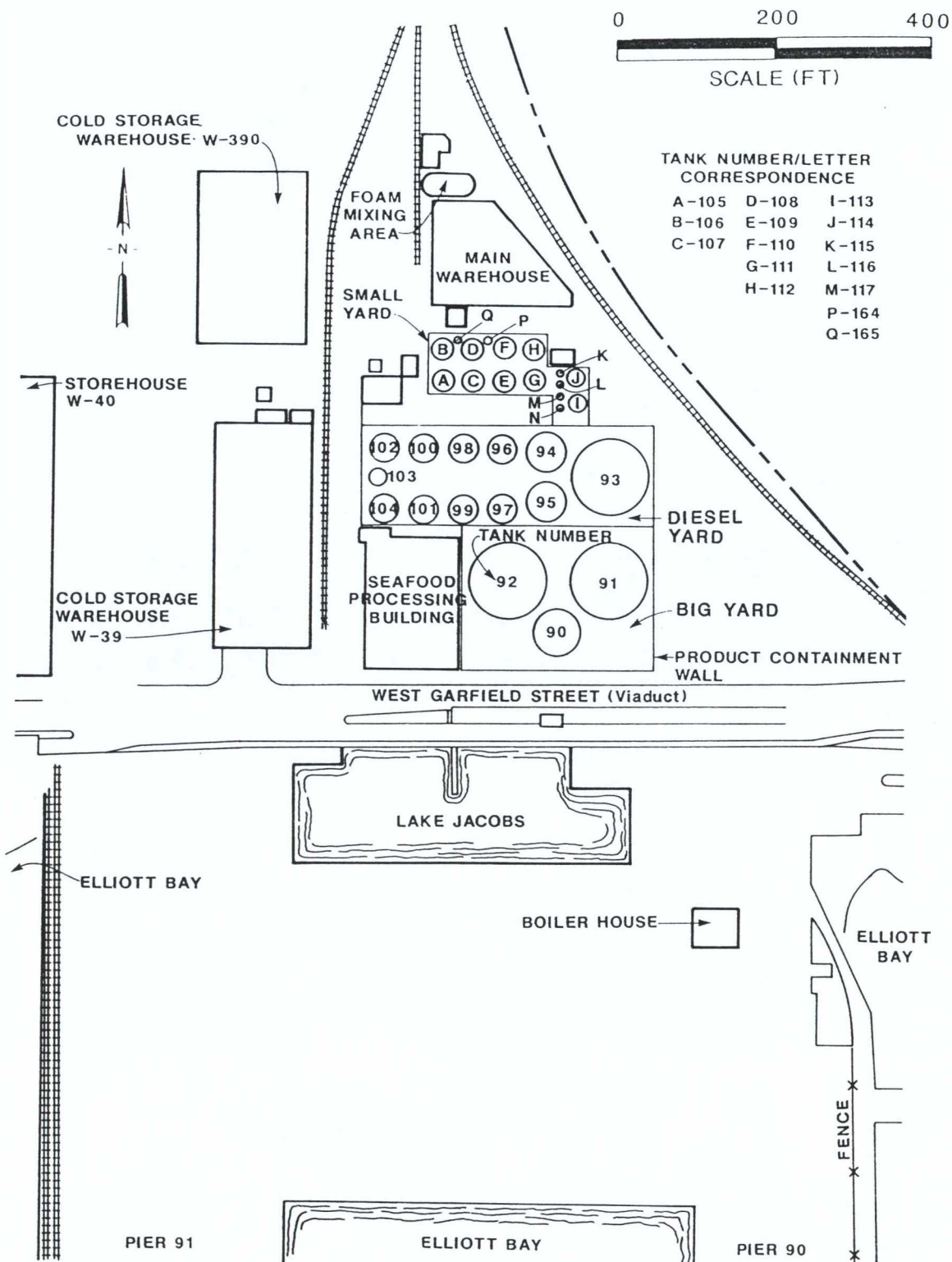
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Figure A-2
CHEMPRO PIER 91 FACILITY
SITE PHYSIOGRAPHIC MAP



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Figure A-3
CHEMPRO PIER 91 FACILITY
SITE MAP

3 PREVIOUS STUDIES

Previous studies performed at or near the Chempro Pier 91 facility include Converse (1989, 1990), Harding Lawson Associates (1990), Hart-Crowser (1981, 1984, 1985, 1988, 1989), GeoEngineers (1987), and Sweet-Edwards/EMCON (SE/E) (1988, 1989). The Converse studies focused on soil and ground water chemistry in the area operated by PANOCO. The Harding Lawson study focused on soil and ground water chemistry associated with a diesel fuel underground storage tank, removed from the area just north of the City Ice building. The work of Hart-Crowser focused on the geotechnical and environmental aspects of the Pier 91 contaminated dredge project, referred to as the "short fill," and the subsequent oil seepage into water ponded behind a fill berm. GeoEngineers' efforts centered on the City Ice and Cold Storage building (warehouse W-390), where they performed a geotechnical and environmental evaluation prior to construction of the warehouse.

SE/E performed two hydrogeologic investigations of the Chempro Pier 91 facility. The work effort of the first SE/E study included collection of soil samples for lithologic identification, field screening, and chemical analysis in four shallow borings; collection of ground water samples from monitoring wells on the site and an existing adjacent Port of Seattle monitoring well; and determination of ground water flow direction, gradient, and hydraulic conductivities.

The second SE/E study involved drilling 11 shallow borings to the base of the shallow water table aquifer; drilling two shallow background soil borings; drilling two deep borings at least 15 feet into the confined aquifer; collection of soil samples; collection of single-time ground water samples from seven of the shallow borings (T-borings); and installation and development of single-completion monitoring wells in four of the shallow borings and two of the deep borings. In addition, the investigation included two rounds of ground water quality sampling, water level measurements, slug tests, and evaluating potential effects of tidal cycles on the shallow water table and the deep confined aquifer systems.

4 FINDINGS OF PREVIOUS STUDIES

The two phases of SE/E investigations at the Chempro Pier 91 Facility produced the following findings and conclusions.

4.1 Site Geology and Hydrogeology

1. The subsurface soils beneath the Pier 91 facility (to a depth of at least 60 feet) consist of silt, silty sand, sand, and gravelly sand. These deposits are likely man-placed fill, overlying in-situ and reworked glacial deposits (similar to those soils composing the surrounding higher topographic areas), and in-situ and reworked marine deposits.
2. The geologic information obtained from drilling and soil sampling indicates the presence of three stratigraphic units beneath the site to a depth of about 60 feet below the ground surface. The stratigraphic units are laterally continuous beneath the site and nearly horizontally bedded.
3. The uppermost stratigraphic unit consists of lenses of fine to medium sand and extends to a depth of 20 feet below the ground surface underneath the entire site. The discontinuous layering and heterogeneous composition of the unit are consistent with features common to fill. Laminations of silt and coarse sand and shell fragments in the unit suggest that it is a hydraulically emplaced fill.
4. The middle geologic unit, composed of silty sand, is probably the original natural sediment of Smith Cove in Elliott Bay. The unit appears to be continuous beneath the site. Scattered shells, wood debris, and faint laminations are evident. The silty sand extends from about 20 feet below the ground surface to a depth of 30 to 45 feet.
5. The deepest geologic unit encountered beneath the site is a

sand and gravelly sand layer, composed of medium to coarse sand, subrounded gravel, and shell fragments. It is a natural sediment of Smith Cove and likely represents both littoral and fluvial deposits. It extends from about 30 feet below the ground surface to a depth of about 60 feet at the southern boundary of the site. The unit was not present at the depth explored at the northern boundary of the site.

6. Three hydrostratigraphic units, corresponding to the three geologic units encountered beneath the site, have been delineated under the facility.
7. The uppermost hydrostratigraphic unit (about 20 feet thick) found beneath the site is considered to be a water table aquifer of relatively uniform thickness. The horizontal hydraulic conductivity of this unit ranges from 10^{-4} to 10^{-2} centimeters per second (cm/sec). Horizontal flow is to the southwest at a gradient of 0.002 feet/foot (ft/ft). The direction of flow and the horizontal gradient are not affected by tidal cycles in Elliott Bay.
8. The middle hydrostratigraphic unit is an aquitard. It lies beneath the entire site. The hydraulic conductivity of the aquitard, determined from a slug test performed in CP-105-B, is 2×10^{-4} cm/sec. There is a downward component of flow across the unit, with a vertical gradient of 0.02 ft/ft.
9. The deepest hydrostratigraphic unit encountered beneath the site is a confined aquifer. The direction of horizontal flow is roughly south-southeast, the horizontal gradient is about 0.0067 ft/ft, and the horizontal hydraulic conductivity is on the order of 10^{-2} cm/sec. The aquifer is influenced by tides up to a projected distance of 400 feet from Elliott Bay. Tidal influence appears to affect the horizontal hydraulic gradient but not the general flow direction. However, local reversals of flow direction could occur at very high tides.

4.2 Site Geochemistry

1. The concentrations of organic compounds and metals in soil samples vary both with depth and laterally. The concentrations of organic compounds in soil decrease

4.3 Site Hydrochemistry

1. No temporal trends were defined for ground water chemical concentrations in the shallow aquifer.
2. BTEX concentrations in the shallow ground water aquifer were detected in all the borings. The highest concentrations were detected in borings TB-2, TB-4, and TB-7 ground water samples at 4.98, 159.0 and 72.0 mg/l, respectively. Toluene and xylenes account for most of the BTEX concentration. BTEX compounds were detected in all the borings.
3. TCH concentrations in the shallow aquifer were highest in boring TB-2 and TB-7 ground water samples at 2.934 and 0.53 mg/l, respectively. Chloroethane, 1,1-dichloroethane, and methylene chloride accounts for most of the TCH concentration.
4. PAH concentrations in the shallow aquifer were highest in boring TB2 at 1.784 mg/l. Bis(2-ethylhexyl) phthalate accounts for most of PAH concentration.
5. Generally low or non-detected levels of total phenol concentrations were found in the shallow aquifer on the site. Exceptions were in ground water samples from borings TB-2 and TB-4, detected at 0.675 and 0.392 mg/l, respectively.
6. The concentration of dissolved metals in the shallow aquifer beneath the site were generally near or below method detection limits.
7. The concentrations of organic compounds in the deep ground water system beneath the site were generally near or below the method detection limits.
8. The concentrations of dissolved metals in the deep confined aquifer beneath the site were generally near or below method detection limits.

significantly with depth below the top of the silty sand confining layer.

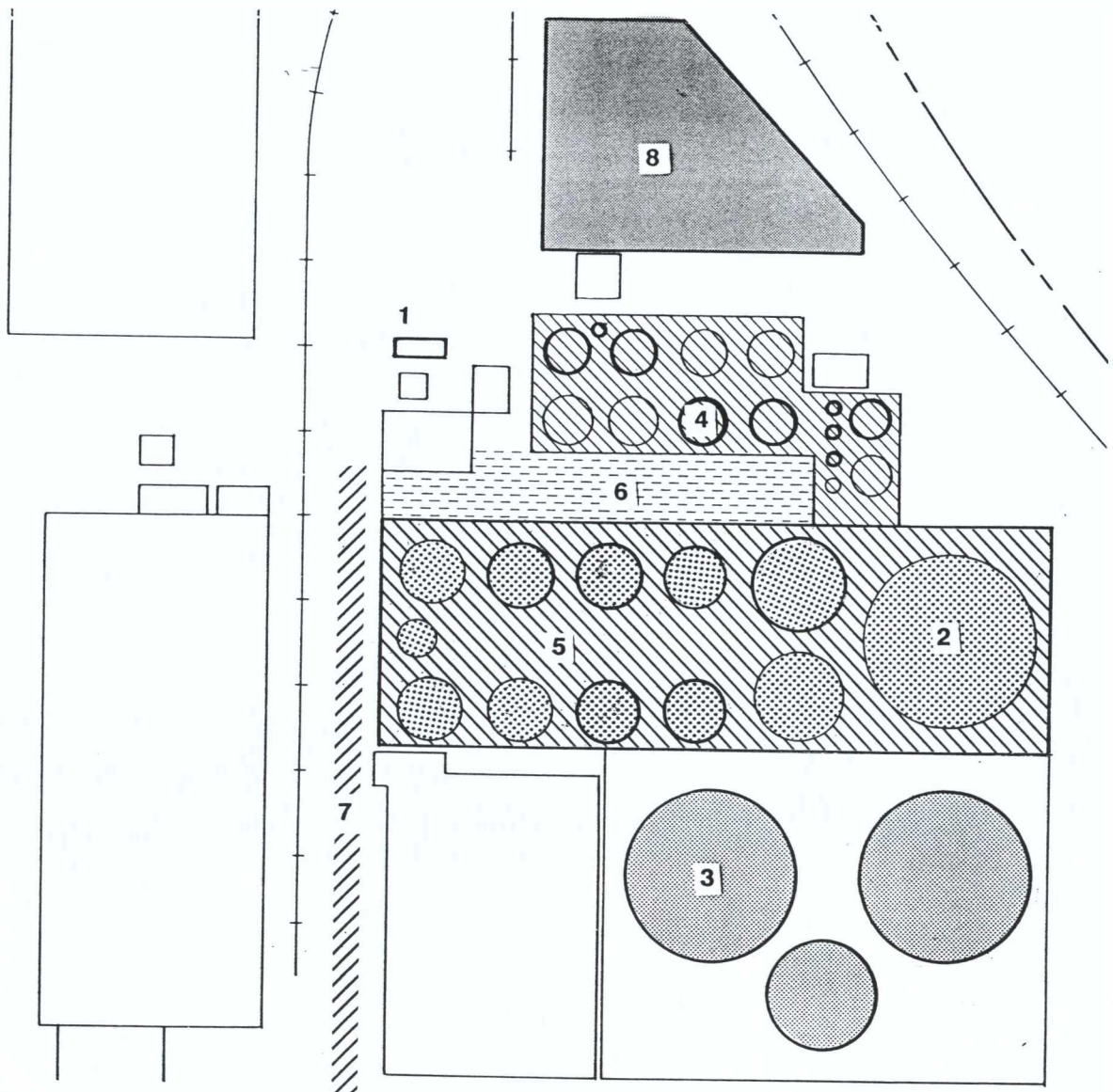
2. Benzene, toluene, ethylbenzene, xylene (BTEX) compounds were detected in soil samples from every boring on-site, except CP-110. High concentrations of BTEX compounds were found in TB-2, TB-4, and TB-7 at values of 78.0, 9,200 and 870.0 milligrams per kilogram (mg/kg), respectively. BTEX concentrations generally decrease with depth to less than detection limits within the silty sand confining layer.
3. Chlorinated hydrocarbon (TCH) compounds were detected in soil samples from every boring at the site except TB-4. High concentrations of TCH compounds were found in TB-2, TB-6, and CP-108-A at values of 12.5, 2.8, and 1.6 mg/kg, respectively. Concentrations generally increased with depth to the top of the silty sand confining layer. The most widespread chlorinated hydrocarbon was methylene chloride.
4. Polynuclear aromatic compounds (PAHs) were detected in soil samples from every boring except background soil borings SB-1. High concentrations of PAHs were found in TB-2, TB-6, CP-107, CP-109, and CP-110 at values of 31.0, 84.0, 51.0, 180.0, and 55.0 mg/kg, respectively. In general, the low molecular weight PAHs such as naphthalene, acenaphthene, fluorene, and phenanthrene were more abundant than high molecular weight compounds such as pyrene, fluoranthene, and chrysene. PAH concentrations decreased below a depth of 10 feet.
5. There did not appear to be a spatial trend in concentration of any of the metals. Trace metals soils concentrations on-site that were greater than either background, Puget Sound Regional Soils, or Average Crustal Soils comparative values were almost exclusively in the unsaturated soils. The saturated fills and the underlying silty sand contained trace metal concentrations that are typical for Puget Sound sediments.

4.4 General Conclusions

The highest concentrations of BTEX compounds and TCH were observed in the vicinity of the oil/water separator, which appears to be a potential source of contamination because of the unit's age and because waste oil is processed through the unit.

4.5 Preliminary Pathways Analysis

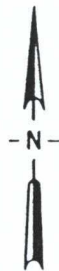
A preliminary pathway analysis was performed for the Chempro Pier 91 site to assist in identifying potential pathways of contaminant migration and the recommendations for further action. Eight potential source areas (identified in Figure A-4) were evaluated as part of this analysis. The analysis was conducted using existing analytical data or information collected by SE/E during their Phase I and Phase II hydrogeological investigations. The recommendations from this analysis are summarized in Table A-1 and are in part the basis of the proposed sampling plan.



SOURCE

1. Oil-Water Separator
2. Diesel Yard Tanks
3. Big Yard Tanks
4. Small Yard Tanks
5. Waste Oil Spill Area

6. Pipe Alley Drainage
7. Piping System
8. Warehouse



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Figure A-4,
CHEMPRO PIER 91 FACILITY
SOURCES IN PATHWAYS ANALYSIS

Table A-1

Chempro Pier 91 Pathway Analysis

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
1) Oil/Water Separator	(Oily Wastewater)	Soil	Soil is a pathway of concern due to documented contamination in soil data collected during hydrological investigation conducted by SE/E.	1) Additional soil characterization data needs to be collected during installation of new wells.
	<u>Soil</u>			
	(TB-2) Toluene Ethylbenzene Xylene Methylene chloride Tetrachloroethene	Surface Water/ Sediments	Surface water is not a pathway of concern due to onsite drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI.
	(CP107) Low conc. PAHs 2-methyl naphthalene phenanthrene Metals - low conc.	Ground Water	Ground water is a pathway of concern (shallow aquifer). Consistent concentrations of volatile compounds (BTEX) and PAHs found (in CP-108-TB-2). Concentrations in deep aquifer generally below detection limit.	2) Ground water evaluation should be continued with the existing well CP-107. Additional ground water characterization needs to be done CP-112 and TB-2.
	<u>Ground Water</u>			
	Low concentration of volatiles (CP-104-A) Vinyl chloride Acetone Xylene Benzene	Subsurface Gas	Subsurface gas is not a pathway of concern based on concentration of contaminants in ground water and solubility of contaminants.	No further action under RFI.
	(CP-107) Chloroethane	Air	Air is not a pathway of concern because the oil/water separator has been cleaned and is no longer used.	No further action under RFI.

Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
1) Oil/Water Separator (cont.)	TB-2 Chloroethane Vinylchloride Acetone 2-butanone Toluene Benzene 2-methyl naphthalene	(See Source 1)		(See Source 1)
2) Diesel Yard Tanks	No existing data, but suspected oil, BTEX, metals, volatile organic compounds TB-5 — very low levels in soil and very low or no detections in ground water	Soil	Soil is a pathway of concern due to suspected overflow of tanks and suspected construction of tanks.	1) Additional soil samples should be collected in the areas (see Source 5) 2) History should be reviewed (i.e., interviews, construction drawings).
		Surface Water/ Sediments	Surface water is not a pathway of concern due to on-site drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI.
		Ground Water	Ground water is a pathway of concern due to suspected overflow of tanks and suspected construction of tanks.	3) An additional ground water monitoring well should be installed between these tanks (see Source 5).
		Subsurface Gas	Subsurface gas is not a pathway of concern based on existing site ground water data near other units.	No further action under RFI.
		Air	Air is a potential pathway of concern due to venting of tanks at the site. Tanks are heated to 190°F.	4) An air assessment will be considered to assess potential migration via the air pathway after evaluation of Chempro air data.

Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
3) Big Yard Tanks	<u>TB-6 — Soil</u>	Soil	Soil is a potential pathway, but data to date does not show significant contamination.	No further action under RFI.
	Toluene Xylene			
	Iron Toluene Xylene	Surface Water/ Sediments	Surface water is not a pathway of concern due to on-site drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI.
	<u>CP-109 — Soil</u>	Ground Water	Ground water is a pathway of concern, but data to date does not show significant contamination.	1) Continue ground water quality sampling in CP-109.
	Low Concentrations of BTEX <u>TB-6, CP-109 - Ground Water</u> Low concentrations volatiles, PAHs	Subsurface Gas	Subsurface gas is not a pathway of concern based on the concentrations of contaminants in ground water.	No further action under RFI.
		Air	Air is a potential pathway of concern due to tank venting.	2) An air assessment may be considered upon review of data.
4) Small Yard Tanks	TB-3 — Low concentration of solvents, volatiles, freon in soil and ground water	Soil	Soil is a pathway of concern based on data from TB-4, TB-7, and CP-106.	1) Additional data is needed, especially downgradient. Soil data should be collected during installation of new wells (CP-116 and CP-117).
	<u>TB-4 — Soil</u> Toluene Ethylbenzene Xylenes	Surface Water/ Sediments	Surface water is not a pathway of concern due to on-site drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI.

Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
4) Small Yard Tanks (cont.)	<u>TB-7 — Soil</u>	Ground Water	Ground water is a pathway of concern based on data from TB-4, TB-7, and CP-106.	2) Additional ground water data is needed. New wells will be installed (CP-114, CP-115, and CP-116) to gather the data. Continue sampling CP-106.
	Acetone TCA Freon TCE Toluene Ethylbenzene Xylene			
	<u>TB-4 — Ground Water</u>	Subsurface Gas	Subsurface gas is not a pathway of concern based on concentration of contaminants in ground water and solubility of contaminants.	No further action under RFI.
	BTEX			
	<u>CP-106 — Ground Water</u>	Air	Air is a potential pathway due to venting of tanks.	3) An air assessment may be considered upon review of data.
	Low concentration volatiles and semivolatiles			
	<u>TB-7 — Ground Water</u>			
	BTEX			
5) Waste Oil Spill Area	Oil Probably BTEX Metals Possible PCBs from previous operations Volatile Organic Compounds	Soil	Soil is a pathway of concern due to documented oil spills.	1) Additional soil samples in the oil spill area are needed near tanks 94, 95, 96, and 97. Soils will be collected during installation of wells CP-118 and CP-119.
Approximately 485,000 gallons of soil spilled on unpaved surface.				2) The analyses will include VOCs, Semi-VOCs, metals, and PCBs.

Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
5) Waste Oil Spill Area (cont.) In 1986, some of soil was excavated.		Surface Water/ Sediments	Surface water is not a pathway of concern due to on-site drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI for this unit.
		Ground Water	Ground water is a pathway of concern due to documented oil spills over the years.	3) An additional ground water monitoring well should be installed between tanks 94, 95, 96, and 97. Additional wells will be installed (CP-118 and CP-119).
		Subsurface Gas	Subsurface gas is not expected to be a pathway of concern due to documented concentrations and nature of contaminants (e.g., solubility of contaminants found in ground water data onsite).	4) The analyses will include VOCs, Semi-VOCs, metals, and PCBs.
		Air	Air is not a pathway of concern from this spill since airborne contaminants from the spill have dissipated. Also, some of the contaminated soil has been excavated.	No further action under RFI. May be reevaluated after analysis of ground water data is collected for this unit.
6) Pipe Alley Drainage Oil Probably BTEX metals Possible PCBs from previous operations Volatile Organic Compounds [Suspected leaks due to contaminants in soil and ground water near oil/water separator — See Source 1 — Oil/Water Separator]		Soil	Soil is a pathway of concern due to suspected leaks. Toluene, ethylbenzene, xylene found in soil near Oil/Water Separator (TB-2).	1) Empty, clean, and inspect pipe alley. 2) Inspect alley for cracks. 3) Collect soil samples if integrity is breached.
		Surface Water/ Sediments	Surface water is not a pathway of concern due to on-site drainage and treatment. Sediments is an unlikely pathway for this unit from past releases due to its distance from the bay and contribution from adjacent properties.	No further action under RFI.
		Ground Water	Ground water is a pathway of concern due to suspected leaks. Ground water found to be of concern at the site.	4) Potential ground water contamination will be evaluated through new and existing monitoring wells (Well CP-116).

Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
Pipe Alley Drainage (cont.)		Subsurface Gas	Subsurface gas is not a pathway of concern due to documented concentrations in ground water and nature of compounds (e.g., solubility). See Source No. 1 (Oil/Water Separator).	No further action under RFI.
		Air	Air is a potential pathway of concern due to airborne migration of volatiles from the pipe alley.	5) An air assessment may be considered upon review of data.
7) Piping System [Documented leaks in piping systems — Port and PANOCO]	Oil Probably BTEX metals Possible PCBs from previous operations Volatile Organic Compounds	Soil	Soil is a pathway of concern because of reported leaks on Port/PANOCO property.	1) Review leak — test procedures/logs of PANOCO 2) Review soil data from other documented leaks (Port data) 3) Assess the need for integrity tests
		Surface Water/Sediments	Surface water/sediments is not a pathway of concern since this is a subsurface unit.	No further action under RFI.
		Ground Water	Ground water is a pathway of concern due to documented leaks in piping system.	1) Review existing Port data 2) Sample ground water quality data from existing Port wells near pipeline.
		Subsurface Gas	Subsurface gas is not known to be a pathway of concern.	No further action under RFI. May be reevaluated after ground water data is collected during RFI.
		Air	The system is not open to the environment. Therefore, air is not a pathway of concern.	No further action under RFI.



Table A-1

Chempro Pier 91 Pathway Analysis

(Continued)

Sources	Contaminants of Concern	----- Potential Pathways -----		Conclusions and Recommendations for RCRA Facility Investigation
8) Warehouse Area	Oils Hydraulic fluid	Soil	Soil is not a pathway of concern due to current practices (concrete floor and storage of product in 55-gallon drums). However, soil may be a pathway of concern from past practices.	1) Soil will be evaluated through past borings (TB-2, TB-3, TB-4) and new borings (CP-115 and CP-120).
		Surface Water/ Sediments	Surface water/sediments is not a pathway of concern due to concrete floor and drainage.	No further action under RFI.
		Ground Water	Ground water may be a pathway of concern due to past practices.	2) Ground water will be evaluated with the installation of new wells (CP-115 and CP-120).
		Subsurface Gas	Subsurface gas is not a pathway of concern due to nature of contaminants and storage on concrete slab.	No further action under RFI.
		Air	Air is not a pathway of concern due to closed storage of product.	No further action under RFI.

PART B

PRELIMINARY TECHNOLOGIES EVALUATION

CHEMPRO PIER 91 PRELIMINARY TECHNOLOGIES EVALUATION

Matrix	Technology	Data Requirements
Ground Water	Extraction	Aquifer storage coefficient Soil type/porosity Hydraulic conductivity Aquifer saturated thickness Contaminant sorption Contaminant solubility Depth to aquifer
Ground Water	Air-stripping	Contaminant volatility GW temperature Flow rate Contaminant concentration
Ground Water	Carbon Adsorption	Contaminant adsorptability Total organic carbon Flow rate
Ground Water	Chemical Destruction	Flow rate Total organic carbon Contaminant concentration
Ground Water	Metals Precipitation	Metals solubility pH Metal concentration
Ground Water	Phase Separation	Contaminant solubility Flow rate Total suspended solids Specific gravity
Ground Water	Biodegradation	Soil type Permeability Contaminant biodegradability Aquifer properties Dissolved oxygen Contaminant concentration
Ground Water	Solvent Wash and Extraction	Soil type Sorption properties Contaminant solubility Organic moisture content Aquifer parameters Depth to aquifer
Ground Water	Vapor Extraction	Soil type Contaminant volatility Contaminant concentration Hydraulic conductivity

CHEMPRO PIER 91
PRELIMINARY TECHNOLOGIES EVALUATION
(Continued)

Matrix	Technology	Data Requirements
Soil	Incineration	Grain size Organic content pH Metals content Waste content Moisture content
Soil	Infrared Thermal Treatment	Grain size Organic content pH Metals content Waste content Moisture content
Soil	Vitrification	Contaminant concentration Depth of contamination Area of contamination Soil type Moisture content Presence of reactive compounds Electrical conductivity Underlying Geology
Soil	Soils Washing	Grain size Organic content pH Metals content Waste content Moisture content
Soil	Dechlorination	Grain size Organic content pH Metals content Waste content Moisture content
Soil	Stabilization/solidification	Grain size Organic content pH Metals content Waste content Moisture content

CHEMPRO PIER 91
PRELIMINARY TECHNOLOGIES EVALUATION
(Continued)

Matrix	Technology	Data Requirements
Soil	Biodegradation	Grain size Organic content pH Metals content Waste content Moisture content Oil and grease content Distribution of microorganisms Biodegradation rate

PART C
SAMPLING PLAN

1 INTRODUCTION

1.1 Objectives

The goal of the hydrogeologic study (Phase III) is to supplement existing data collected by Sweet-Edwards/EMCON (SE/E) during two previous investigations conducted at the Chemical Processors, Inc. (Chempro) facility located at Pier 91 in Seattle, Washington. The primary objectives are to:

- Identify site historical uses which would impact the scope of this investigation.
- Identify potential populations at risk (e.g., beneficial use survey).
- Evaluate sources of release and potential release of hazardous waste or constituents.
- Determine the nature and extent of hazardous substances in ground water and soil on the facility.

The findings of this investigation, coupled with information collected during the past investigations will be used to meet the requirements of a RCRA facility investigation (RFI) as mandated under a 3008 Order and as defined under EPA guidance.

1.2 Investigation Approach/Summary of Work Scope

The proposed scope of work developed for this investigation is based on results of the previous investigation performed by SE/E (1988, 1989) and the requirements of an EPA 3008 Order. The proposed scope of work includes performing historical site use and beneficial use surveys, drilling 10 shallow borings, collecting subsurface soil samples for chemical and engineering testing from each boring, installing a monitoring well in each boring, collecting ground water samples from 23 wells within or adjacent to

the facility, conducting hydraulic conductivity tests in each new well, and obtaining two rounds of water levels in the wells within or adjacent to the site. The boring locations are shown on Figure C-1. Deeper borings into the aquitard or the lower aquifer are not proposed based on (1) the presence of a continuous aquitard beneath and adjacent to the site and (2) the results of the chemical testing performed on water samples taken from the deeper monitoring wells. The proposed monitoring wells will be screened across the water table with 8- to 10-foot length screens. Nested monitoring wells, consisting of two or more wells screened at different depth intervals, will not be used because the aquifer is generally less than 15 feet thick.

Chemical testing of soil and ground water will include volatile organics (Method 8240), base-neutral-acid organics (Method 8270), PCBs (Method 8080), total petroleum hydrocarbons (Methods 418.1 and 8015), total dissolved metals (water only), and TCLP metals (soil only). Additional analyses may be included at select locations pending a review of materials reportedly handled and/or treated at the site.

Table C-1 summarizes the drilling and sampling program. Included in the table is the rationale for selecting each boring location.

The scope of work proposed in this work plan includes the following tasks. These were developed to meet the requirements of the RCRA RFI.

<u>Task</u>	<u>Description</u>
1	SE/E will review historical site records, maps, and photographs to correlate facility conditions with past operational practices, locate subsurface pipes and stormwater drainlines, and delineate any additional potential contaminant migration pathways.
2	Coordinate with Chempro to review documentation of materials handled and/or treated on-site in order to complete the list of parameters for testing soils and water.
3	Coordinate with Chempro to field check drilling locations, identify underground utilities, and supervise site preparation for drilling. Obtain permission for access on adjacent properties (if necessary).

DATE _____
DWN. _____
APPR. _____
REVIS. _____
PROJECT NO. S940705

Figure C-1
CHEMPRO PIER 91 FACILITY
BORING AND
MONITORING WELL LOCATIONS

TABLE C-1

SUMMARY OF SITE SELECTION CRITERIA
CHEMICAL PROCESSORS, INC.
PIER 91 FACILITY

Boring Designation	Boring Type	Engineering Soil Testing	Chemical Soil Testing	Chemical Ground Water Testing	Location	Rationale for Site Selection
CP-111	Shallow Monitoring Well	X	X	X	SW of facility, S of Warehouse 39	-Downgradient of the facility -Unexplored area -Will determine SW extent of contamination
CP-112	Shallow Monitoring Well	X	X	X	W of site, between Warehouses 39, 390	-Downgradient of the facility -Unexplored area -Will determine W extent of contamination
CP-113	Shallow Monitoring Well	X	X	X	W of facility warehouse; NW of oil-water separator	-Downgradient of north part of facility -Unexplored area -Will determine NW extent of contamination
CP-114	Shallow Monitoring Well	X	X	X	NW of Small Yard; E of site warehouse	-Upgradient of the Small Yard -Unexplored area -Will provide shallow aquifer background data
CP-115	Shallow Monitoring Well	X	X	X	N of Small Yard; S of site warehouse	-Near location of TB-4 -Will provide continued monitoring of a location with high analyte concentrations in a previous investigation.
CP-116	Shallow Monitoring Well	X	X	X	SW corner of the Small Yard	-In the previously unexplored Small Yard -Downgradient of the tanks in the yard
CP-117	Shallow Monitoring Well	X	X	X	SW corner of the Small Yard	-In the previously unexplored Small Yard -Downgradient of the tanks in the yard
CP-118	Shallow Monitoring Well	X	X	X	W end of the Diesel Yard	-In the previously unexplored Diesel Yard -Downgradient of the northern row of tanks
CP-119	Shallow Monitoring Well	X	X	X	Center of Diesel Yard	-In the previously unexplored Diesel Yard -Downgradient of the northern row of tanks
CP-120	Shallow Monitoring Well	X	X	X	NE of oil-water separator	-Near the oil-water separator and TB-2 -Will provide continued monitoring of a location with high analyte concentrations in a previous investigation.

Notes:

- 1) Refer to Table C-3 for reference methods and analytical laboratories
- 2) Refer to Figure A-3 for structural locations, Figure C-1 for boring locations

- 4 A beneficial use survey within a 1/2 mile radius of the Pier 91 facility to identify the location of industrial, public, and private water supply wells.

<u>Task</u>	<u>Description</u>
5	Drill and soil sample 8 shallow (approximately 15 feet below grade) borings for monitoring well installations.
6	Drill and soil sample 2 shallow (approximately 20 feet below grade) borings for monitoring well installations.
7	Analyze 2 soil samples from each of the 10 new borings.
8	Sample and analyze ground water from 6 existing on-site monitoring wells, 6 new on-site monitoring wells, and 11 off-site wells.
9	Conduct rising head slug tests in the 10 new monitoring wells.
10	Obtain two rounds of water levels in all on-site and off-site wells.
11	Evaluate chemical and engineering test results on soil and water samples.
12	Prepare a report documenting the field investigation and data evaluation, including: <ul style="list-style-type: none">• Boring Logs• Summary of Completed Borings• Chain-of-Custody/Laboratory Request Forms• Laboratory Analyses• Water Level Data• Geology• Hydrology• Geochemical Data Evaluation• Quality Assurance Review

1.3 Project Schedule

A schedule for the performance of all the work described is attached as Part E. Following the completion of all tasks, a summary report will be submitted in duplicate to EPA Project Coordinator, RCRA Compliance Section, EPA Region 10, 1200 Sixth Avenue, M/S HW-112, Seattle, Washington 98101.

1.4 Site Access

All reasonable efforts will be made to provide and assist employees, agents and contractors of the EPA access to the Pier 91 site in accordance with and pursuant to the authority of 3007 of the Act, 42 U.S.C. 6927. Upon arrival at the site, EPA representatives must proceed directly to the facility office and be able to provide proper identification to the facility manager. After signing a visitor registration log and describing the purpose of the visit, person(s) will be escorted at all times, while on-site, by Chempro personnel. In some cases, site access may be temporarily limited or restricted due to safety concerns resulting from facility operations.

1.5 Limitations

Should Chempro be unable to acquire access to off-site property to accomplish the directives of any portion of this Work Scope, a signed statement as to the efforts made by Chempro to acquire such access, the responses made thereto by the appropriate property owners, and copies of letters or other correspondence made as part of those efforts will be submitted to the EPA.

2 HISTORICAL SITE EVALUATION

A review of historical site records, aerial photographs, and maps of the Pier 91 facility will be conducted to correlate facility conditions and past operational practices. Representatives of the Port of Seattle, Chempro, the City of Seattle, local property owners, and the regulatory agencies (EPA, Ecology) will be interviewed to determine the availability of applicable environmental records. Particular attention will be paid to identifying the historical locations of tank farms, subsurface piping, and spills. The site history, from available records, will be summarized in the RFI report.

3 BENEFICIAL USE SURVEY

A survey of the beneficial use of ground water in a 1/2-mile radius of the facility will be conducted. The survey will involve a review of well logs available from the State of Washington Department of Ecology (Ecology). Well locations will be field checked as appropriate.

The findings of this beneficial use survey will be summarized in the RFI report and be utilized to determine the potential pathways targets or human receptors in the vicinity of the Chempro Pier 91 facility.

4 SITE SAFETY

The field investigation will follow the Quality Assurance Project Plan and Site Safety Plan (Parts F and G, respectively, in this proposal). The Site Safety Plan will be followed with regard to personnel safety during drilling procedures and the handling and sampling of soil and ground water.

5 DECONTAMINATION PROCEDURES

The working area of the drill rig and all down-hole drilling equipment will be steam cleaned/hot water pressure washed prior to arrival at and departure from the site and between drilling locations. All soil and ground water sampling equipment will be decontaminated using the following sequence:

- Non-phosphatic detergent wash
- Distilled water rinse
- Dilute acid rinse (pH <2)
- Distilled water rinse
- Methanol solution rinse (1:1 solution with deionized distilled water)
- Five minute "air dry" time
- Final deionized distilled water rinse

All decontamination fluids will be placed in containers provided by and disposed of by Chempro.

6 RESIDUALS MANAGEMENT

All residual soils, ground water, contaminated clothing, and decontamination solutions shall be handled as hazardous waste. Appropriate personal protective clothing, shall be worn during waste transfers because of potential skin contact and splash hazards.

Waste management procedures are as follows:

- All waste shall be transferred into 55-gallon waste drums.
- The waste shall be identified with sample number, date of collection, location of site and sample, waste description and volume or quantity of waste.
- The waste drum shall be sealed, secured, and transferred to a location inside the Chempro facility at the end of each work day.
- The waste shall be stored in a temporary designated holding area within the Pier 91 facility prior to off-site shipment.
- An on-site staging area for accumulation of wastes will be identified by Chempro.
- Chempro will be responsible for disposition of the wastes.

7 DRILLING AND SOIL SAMPLING

Prior to beginning the field program, access agreements for any off-site monitoring or sampling will be obtained by Chempro, and all drilling locations will be checked for the presence of underground utilities and piping.

7.1 Drilling Procedures

Ten borings will be drilled for soils identification, visual indication of contamination, chemical analysis of selected soil samples, and the installation of monitoring wells. Specific procedures are as follows.

1. Eight borings (CP-113 through CP-120) will be advanced about 8-feet below the water table (total depth of about 14 feet) in the upper aquifer. Two borings (CP-111 and CP-112) will be drilled to the top of the aquitard (total depth of about 15 to 20 feet). A hollow-stem auger drill rig will be used to drill all off-site borings, and CP-115 and CP-120 on-site. Six-inch inside diameter (I.D.) auger flights will be used.
2. A portable drill rig with solid auger flights will be used to drill CP-116, CP-117, CP-118, and CP-119 if access is possible. If access cannot be gained with a portable drill rig, drilling will be attempted with a hand auger.
3. Surface concrete or asphalt at each drilling location will be cored or excavated using a pneumatic hammer prior to drilling. Additionally, a pry bar and post-hole digger will be used to probe for subsurface piping to a depth of about 2 feet prior to initiating drilling.
4. A continuous log of subsurface soils will be prepared for each boring by a hydrogeologist or engineer. Each boring log will include the name and location of project, boring number, well number, drilling contractor, drilling method, sampling method,

soil sample locations, sampler blow counts, and detailed descriptions of soils. Soil descriptions will include color, grain size, organic matter, moisture content, density, the presence of oil, and any other observed characteristics. Daily site activity will be documented in a field notebook.

5. All soil and water collected during drilling and sampling of the borings will be stored in appropriate containers provided by Chempro. Each container will be clearly marked on the top and side with the type and the source of the contents. The material will be stored until sampling results are obtained and then disposed of by Chempro.
6. Prior to initial use on the project and between each boring, all down-hole drilling equipment will be steam-cleaned.

7.2 Soil Chemical Analysis

At least two soil samples from each boring will be sent to the appropriate laboratories for chemical analysis. One sample from above the water table and one from below the water table will be tested. Visual sample inspection will be used to select additional samples which may be analyzed. Table C-2 presents the chemical analyses to be performed on each sample scheduled for testing. Additional samples will be tested for the same constituents as other soil samples from the same boring. The test methods used and laboratories performing the analyses are listed in Table C-3. The specific constituents of the VOC, BNA, PCB, and metals analyses are shown in Table C-4.

7.3 Soil Sampling Procedures

Soil will be sampled continuously from the soil surface to the bottom of each boring. Following are the soil sampling procedures.

1. To obtain soil samples, a 2-inch outside diameter (O.D.) split spoon and/or a 3-inch O.D. barrel sampler will be driven ahead of the auger bit in 18-inch to 24-inch depth intervals.
2. It is expected that the water table in the shallow aquifer will be about 6 feet below the ground surface. Soil samples taken between 2 and 4 feet depth and 6 and 8 feet depth will be sent to the laboratory for chemical analysis. Soil samples

TABLE C-2

SUMMARY OF SOIL SAMPLES FOR TESTING
CHEMICAL PROCESSORS, INC.
PIER 91 FACILITY

Boring Designation	Sample Depth	Volatile Organics	Base-Neutral-Acid Organics	PCB's	TPH (418.1)	TPH (8015)	TCLP Metals	Engineering Tests
CP-111	2-4	X	X	-	X	-	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	-	X	-	X	-
	8-10	-	-	-	-	-	-	X
CP-112	2-4	X	X	-	X	-	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	-	X	-	X	-
	8-10	-	-	-	-	-	-	X
CP-113	2-4	X	X	-	X	-	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	-	X	-	X	-
	8-10	-	-	-	-	-	-	X
CP-114	2-4	X	X	-	X	-	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	-	X	-	X	-
	8-10	-	-	-	-	-	-	X
CP-115	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X

Notes:

- 1) (*) Estimated sample depth based on an expected depth to water of 6 feet; sample depth may be altered if the depth to water varies from that expected.
- 2) (#) Estimated sample depth based on an expected depth to water of 6 feet; The sample is intended to be taken immediately below the water table; sample depth will be altered if the depth to water varies from that expected.
- 3) (X) indicates analyses to be performed
- 4) (-) indicates analyses not to be performed
- 5) Sample Depth refers to those samples for laboratory testing, all borings to be continuously sampled for lithologic determination
- 6) Refer to Table C-3 for reference methods and analytical laboratories
- 7) Refer to Figure C-1 for boring and surface sample locations

TABLE C-2
(continued)
SUMMARY OF SOIL SAMPLES FOR TESTING
CHEMICAL PROCESSORS, INC.
PIER 91 FACILITY

Boring Designation	Sample Depth	Volatile Organics	Base-Neutral-Acid Organics	PCB's	TPH (418.1)	TPH (8015)	TCLP Metals	Engineering Tests
CP-116	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X
CP-117	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X
CP-118	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X
CP-119	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X
CP-120	2-4	X	X	X	X	X	X	-
	4-6 (*)	-	-	-	-	-	-	X
	6-8 (#)	X	X	X	X	X	X	-
	8-10	-	-	-	-	-	-	X

Notes:

- 1) (*) Estimated sample depth based on an expected depth to water of 6 feet; sample depth may be altered if the depth to water varies from that expected.
- 2) (#) Estimated sample depth based on an expected depth to water of 6 feet; The sample is intended to be taken immediately below the water table; sample depth will be altered if the depth to water varies from that expected.
- 3) (X) indicates analyses to be performed
- 4) (-) indicates analyses not to be performed
- 5) Sample Depth refers to those samples for laboratory testing, all borings to be continuously sampled for lithologic determination
- 6) Refer to Table C-3 for reference methods and analytical laboratories
- 7) Refer to Figure C-1 for boring and surface sample locations

TABLE C-3

SUMMARY OF SAMPLE TESTING
CHEMICAL PROCESSORS, INC.
PIER 91 FACILITY

Matrix	Parameter	Reference Method	Laboratory
Water and Soil	Volatile Organics (VOCs)	EPA Method 8240(624)	Chempro Laboratory
Water and Soil	Semivolatile Organics (BNAs)	EPA Method 8270 (625)	Analytical Resources, Inc.
Water and Soil	PCBs	EPA Method 8080 (608)	Chempro Laboratory
Water and Soil	Total Petroleum Hydrocarbons (TPH)	EPA Method 418.1	Analytical Resources, Inc.
Water and Soil	TPH	EPA Method 8015	Analytical Resources, Inc.
Water	<u>Total Metals</u>		
	Arsenic	EPA Method 7060	Chempro Laboratory
	Beryllium	EPA Method 7090/6010	
	Cadmium	EPA Method 7130/6010	
	Chromium	EPA Method 7190/6010	
	Copper	EPA Method 7210/6010	
	Lead	EPA Method 7421	
	Mercury	EPA Method 7470	
	Nickel	EPA Method 7520/6010	
	Zinc	EPA Method 7950/6010	
Soil	<u>TCLP Metals</u>		
	Arsenic	EPA Method 1311/6010	Columbia Analytical
	Barium	EPA Method 1311/6010	Services, Inc. or
	Cadmium	EPA Method 1311/6010	Chempro Laboratory
	Chromium	EPA Method 1311/6010	
	Lead	EPA Method 1311/6010/7421	
	Mercury	EPA Method 1311/7470	

Table C-4

SAMPLING PARAMETERS AND LABORATORY METHODOLOGY

<u>EPA Method 8240</u>	<u>EPA Method 8270</u>	<u>EPA Method 8270</u> (continued)
Chloromethane	Phenol	Phenanthrene
Bromomethane	bis(2-Chloroethyl)Ether	Anthracene
Vinyl Chloride	2-Chlorophenol	Di-n-Butylphthalate
Acetone	1,3-Dichlorobenzene	Fluoranthene
Chloroethane	1,4-Dichlorobenzene	Pyrene
Methylene Chloride	Benzyl Alcohol	Butylbenzylphthalate
Carbon Disulfide	1,2-Dichlorobenzene	3,3-Dichlorobenzidine
1,1-Dichloroethene	2-Methylphenol	Benzo(a)Anthracene
1,1-Dichloroethane	bis(2-chloroisopropyl)Ether	bis(2-Ethylhexyl)Phthalate
1,2-Dichloroethene (Total)	4-Methylphenol	Chrysene
Chloroform	N-Nitroso-Di-n-Propylamine	Di-n-Octyl Phthalate
1,2-Dichloroethane	Hexachloroethane	Benzo(b)Fluoranthene
2-Butanone	Nitrobenzene	Benzo(k)Fluoranthene
1,1,1-Trichloroethane	Isophorone	Benzo(a)Pyrene
Carbon Tetrachloride	2-Nitrophenol	Indeno(1,2,3-cd)Pyrene
Vinyl Acetate	2,4-Dimethylphenol	Dibenz(a,h,)Anthracene
Bromodichloromethane	Benzoic Acid	Benzo(ghi)Perylene
Trichlorofluoromethane	bis(2-Chloroethoxy)Methane	
1,1,2-Trichloro-	2,4-Dichlorophenol	<u>EPA Method 7060</u>
1,2,2-Trifluoroethane	1,2,4-Trichlorobenzene	Arsenic
1,2-Dichloropropane	Naphthalene	
cis-1,3-Dichloropropene	4-Chloroaniline	<u>EPA Method 7421</u>
Trichloroethene	Hexachlorobutadiene	Lead
Dibromochloromethane	4-Chloro-3-Methylphenol	
1,1,2-Trichloroethane	2-Methylnaphthalene	<u>EPA Method 7470/7471</u>
Benzene	Hexachlorocyclopentadiene	Mercury
Trans-1,3-Dichloropropene	2,4,6-Trichlorophenol	
2-Chloroethylvinylether	2,4,5-Trichlorophenol	<u>EPA Method 8080</u>
Bromoform	2-Chloronaphthalene	PCB-1016
4-Methyl-2-Pentanone	2-Nitroaniline	PCB-1221
2-Hexanone	Dimethyl Phthalate	PCB-1232
Tetrachloroethene	Acenaphthylene	PCB-1242
1,1,2,2-Tetrachloroethane	3-Nitroaniline	PCB-1248
Toluene	Acenaphthene	PCB-1254
Chlorobenzene	2,4-Dinitrophenol	PCB-1260
Ethylbenzene	4-Nitrophenol	
Styrene	Dibenzofuran	<u>EPA Method 7520/6010</u>
Total Xylenes	2,4-Dinitrotoluene	Nickel
	2,6-Dinitrotoluene	
<u>EPA Method 7090/6010</u>	Diethylphthalate	<u>EPA Method 7950</u>
Beryllium	4-Chlorophenyl-phenylether	Zinc
	Fluorene	
<u>EPA Method 7130/6010</u>	4-Nitroaniline	<u>EPA Method 7080/6010</u>
Cadmium	4,6-Dinitro-2-Methylphenol	Barium
	N-Nitrosodiphenylamine(1)	
<u>EPA Method 7190/6010</u>	4-Bromophenyl-phenylether	
Chromium	Hexachlorobenzene	
	Pentachlorophenol	
<u>EPA Method 7210/6010</u>		
Copper		

taken between 4 and 6 feet depth and 8 and 12 feet depth will be sent to a geotechnical laboratory for grain size analysis and Atterberg limits determination. If field conditions are different than expected or sample recovery is less than 100 percent, soil sample analysis may be performed on samples obtained from intervals different than those just stated.

3. Soil samples to be chemically tested will be handled as follows:

- The sampler will be placed and opened on a clean piece of plastic sheeting.
- The volatile organics (VOA) sampling bottle will be filled first at each location from the most contaminated portion of the sample (determined visually). Each VOA bottle will be filled as full as possible to minimize head space.
- The sample will be logged and photographed.
- Soil will be placed in the remaining sample jars provided by the analytical laboratory with a clean stainless steel spoon.
- Sample containers will be labeled with the site name, boring designation, depth, date, project, and sampler's initials.
- Once labeled, sample containers will be placed in an iced cooler and custody maintained until delivery to the appropriate laboratories.
- A Field Sampling Data Form and a Chain-of-Custody/Laboratory Analysis Request Form will be filled out.
- The cooler with signed Chain-of-Custody/Laboratory Analysis Request Form enclosed in a waterproof bag will be sealed and shipped to the appropriate laboratories within 24 hours.

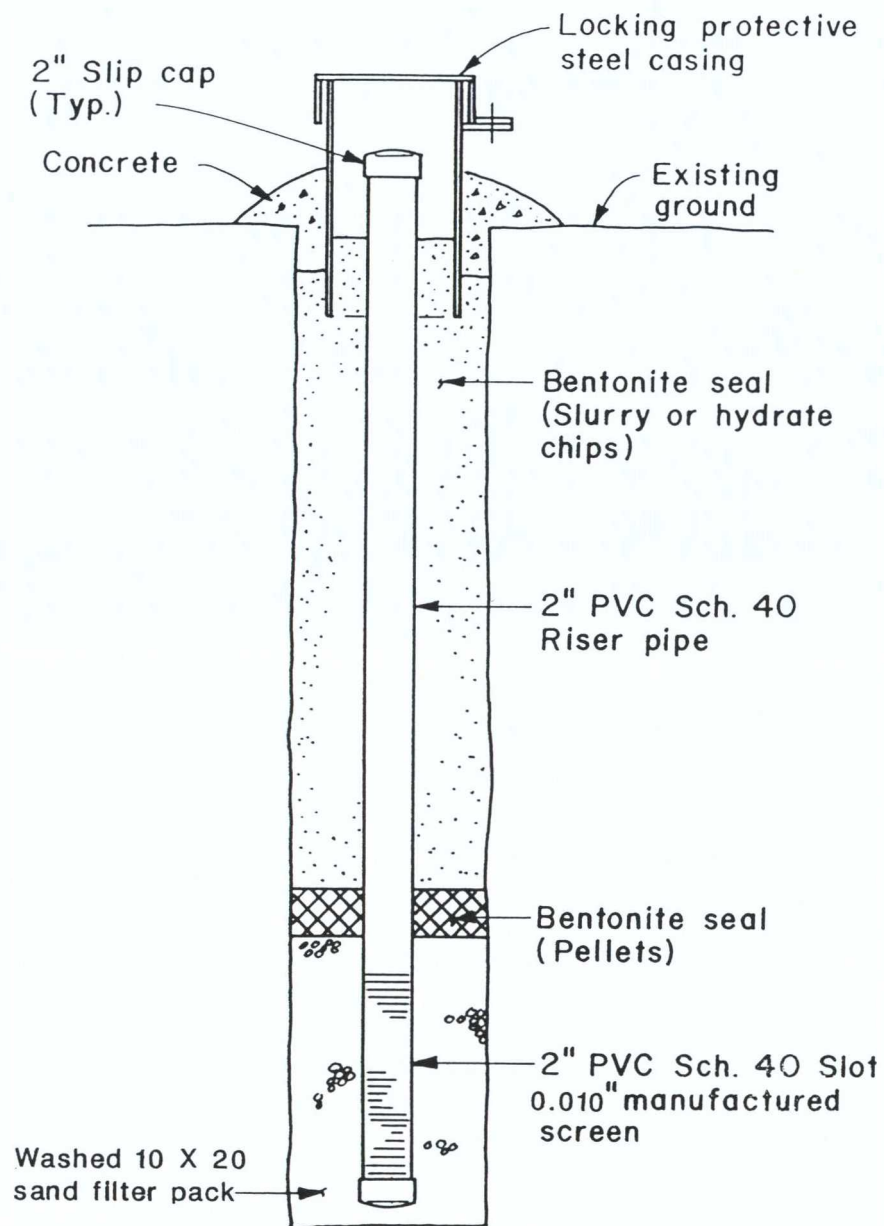
4. Soil samples to be sent for engineering testing will be placed in plastic bags or jars, labeled as above, and shipped to the laboratory.
5. A small jar will be filled with soil from intervals not being chemically analyzed, will be covered with saran wrap, and analyzed with a photoionizing instrument (HNU, TIP, or MicroTIP). Such analyses will occur prior to soil logging and photographing.
6. Soil samples collected during drilling but not submitted for analysis will be placed in plastic bags or containers and archived at the SE/E Bothell office. Archived soil samples will be labeled with the site name, boring designation, sample depth, date, and name of collector.

8 MONITORING WELLS

8.1 Installation Procedures

Single-completion monitoring wells will be installed in each boring consistent with requirements of WAC 173-160, Part 3, "Resource Protection Well Guidelines." Figure C-2 presents a typical monitoring well design for the shallow zone. Following is a summary of the installation procedures.

1. Each off-site monitoring well and on-site wells CP-115 and CP-120 will consist of 10 feet of 2-inch I.D. 0.020-inch machine slot PVC screen fitted with threaded PVC riser pipe. Each of these wells will have one stainless steel centralizer placed near the bottom of the screen. The screen will be positioned so that about 7 feet of it is below the water table and 3 feet of it is above the water table.
2. Wells installed in monitoring wells CP-116, CP-117, CP-118, and CP-119 will consist of a 8-foot long, 2-inch I.D. stainless steel drive point that has been driven into the boring after removal of the solid-stem auger. The drive point will be fitted with stainless steel riser pipe. About 5 feet of the screen will be below the water table.
3. A filter pack of No. 10 x 20 Colorado Silica Sand will be placed around and extend about 1-foot above and about 6 inches below the screened interval in all off-site monitoring wells and in wells CP-115 and CP-120. The annular space above and below the filter pack in these wells will be backfilled with bentonite chips. The upper 2 feet of wells CP-116, CP-117, CP-118, and CP-119 will be backfilled if possible with bentonite chips.



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EMCON

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DWN. _____
APPR. _____
REVIS. _____
PROJECT NO.
S940705

Figure C-2
CHEMPRO PIER 91 FACILITY
TYPICAL
MONITORING WELL COMPLETION

4. A locking protective casing will be cemented over each well. Surface completions will be about 2-feet above ground surface or, in high traffic areas, at grade. Above-grade well completions will consist of a locking steel security casing with two small-diameter (approximately 1/2-inch) vent holes slightly above the sloping concrete surface seal and at least 1 foot below the well cap. Pea gravel will be placed in the annular space between the security casing and the well from about 6 inches below grade to within 6 inches of the well cap.

For below-grade completions, efforts will be made to minimize the potential of surface water entering the well annulus or the well itself. These efforts will include positioning the surface security casing at or slightly above surface grade, installing a locking watertight cap, construction of a downward-sloping PVC drain/vent from inside the well security vault to drain rock, and sloping the surface concrete seal away from the flush-mounted well security vault.

5. Well construction for off-site monitoring wells and well CP-115 will be concurrent with the removal of the hollow stem auger from the borehole. For wells CP-116, CP-117, CP-118, and CP-119, well construction will occur after removal of the solid-stem auger.
6. All well casings, screens, and centralizers will be steam cleaned, or high pressure hot water washed prior to installation. Additionally, the labels and binding tape will be removed before the equipment is installed in the well.
7. Representative samples of annular sand backfill, rinse water, and other potentially contaminating materials will be retained for laboratory analysis.
8. Materials required for the construction of each well and the well completion details will be recorded. The total depth of the boring and placement depths of the filter pack, the bentonite seal, and the surface completion will be measured to the nearest 0.1 feet using a fiberglass tape with a stainless steel weight.

8.2 Well Development

Following installation of each monitoring well, the screen zone will be developed by pumping or bailing. The screen zone will be considered developed when the discharge water is free of sediment and is non-turbid or when field measurements of pH and conductivity have stabilized. However, if after four hours of pumping or bailing the well water does not clear, the monitoring well will be considered developed.

All development water will be stored in appropriate containers provided by Chempro. Each container will be clearly marked on the top and side with the type and the source of the contents. The development water will be stored until sampling results are obtained and then disposed of by Chempro.

8.3 Surveying

The new monitoring wells will be surveyed by a registered surveyor. The monitoring wells will be surveyed for ground surface elevation (nearest 0.1 foot), PVC elevation (nearest 0.01 foot), and horizontal position (nearest 1.0 foot). A filed notch will be placed on the PVC well casing indicating the surveyed point. Vertical surveys will be of third-order accuracy. The vertical datum used to survey the monitoring wells will be the City of Seattle datum. The horizontal datum will be the State Plane System.

9 WATER SAMPLING AND ANALYSIS

Ground water sampling methods to be used at the Pier 91 facility are designed to obtain samples representative of in-situ ground water quality, with minimum agitation or cross contamination of samples due to sampling techniques or materials.

Prior to beginning the field program, access agreements for any off-site monitoring or sampling will be obtained by Chempro.

9.1 Water Sampling Procedures

One round of ground water samples will be obtained from all new monitoring wells and existing wells CP-103-A, CP-103-B, CP-104-A, CP-104-B, CP-105-A, CP-105-B, CP-106, CP-107, CP-108-A, CP-108-B, CP-109, CP-110, and Port of Seattle Well 10 (Well 10). Sampling procedures are as follows.

1. In all wells but Well 10, the depth to water will be measured using an electric water level indicator (Olympic well probe, Model 300 or equivalent) and the presence of floating and sinking contaminants checked using a Masterflex high-capacity peristaltic pump and a Teflon bailer respectively. A peristaltic pump will first withdraw ground water from the phreatic surface. A Teflon bailer will be lowered to the well bottom to obtain a sample. Any indications of floating or sinking contaminants will be noted on the appropriate Field Sampling Data form. Depth to water in Well 10 will be measured using the air bubbler installed in the well.
2. Prior to ground water sampling, a minimum of 3 casing volumes will be purged using a Masterflex high-capacity peristaltic pump fitted with silicon and tygon tubing, a bladder-type pump fitted with tygon tubing, or a Teflon bailer secured with monofilament line.

3. Temperature, pH, and specific conductance will be measured with a Taylor pocket thermometer and a DSPH-3 pH/conductivity meter, respectively, and recorded after the removal of each well casing volume during purging. The parameters will be required to stabilize to within ± 10 percent prior to obtaining a sample. Measurements will be recorded to the following standards: pH to ± 0.01 units, conductivity to ± 1 umho/cm, temperature to $\pm 0.5^{\circ}\text{C}$. All field test equipment will be calibrated approximately every 4 hours of sampling.
4. All sampling field activity and data including well purging data, the type of container used to hold each sample, and any preservative used will be recorded on a Field Sampling Data Form. Any deviations from the general sampling procedure will be noted on field documentation records and will be brought to the attention of the Project Manager.
5. Once a minimum of three pore volumes are purged and field parameters stabilized (or the well has been purged dry and recovered), four replicate measurements of temperature, pH and specific conductance will be obtained and recorded.
6. Ground water samples will be collected directly from the peristaltic or bladder pump discharge line or by using a Teflon bailer.
7. Samples collected for dissolved metals will be filtered at the time of sample collection using QED Sample Pro or similar 0.45-micron, in-line filters. The disposable filters will attach directly to the peristaltic pump discharge tube. Each in-line filter shall only be used once. Ground water samples collected for laboratory testing of VOCs, BNAs, TPH, PCBs, and total metals will not be field or laboratory filtered.
8. Samples will be transferred in the field from the sampling equipment to a container specifically prepared for given parameters. Samples for VOCs will be collected first at each location using a Teflon bailer. A bottom drain sampling device will be used to collect samples from the Teflon bailer. The sample will be poured down the sides of the sample bottle and not splashed into its base. Samples collected for VOCs will have no head space to minimize the possibility of volatilization of the organics.

9. Sample containers will be labeled immediately prior to or following sample collection with project name or number, site name, sample number, date and time of collection, and sample collector.
10. Samples will be labeled and shipped to the appropriate analytical laboratory as described in Section 9, Part B.
11. Quality control samples to be included in the ground water sampling event consist of two duplicate samples, three field (method) blanks, and two transport blanks (Part F). Duplicate ground water samples will be collected from monitoring wells CP-111 and CP-120. Transport blanks will be provided by the Chempro Analytical Laboratory.

9.2 Water Chemical Analysis

Table C-5 presents the chemical analyses to be performed on each water sample. The test methods used and laboratories performing the analyses are shown in Table C-3. The specific constituents of the VOC, BNA, PCB, and metals analyses are shown in Table C-4.

TABLE C-5

SUMMARY OF WATER SAMPLES AND ANALYSES
 CHEMICAL PROCESSORS, INC.
 PIER 91 FACILITY

Existing Monitoring Wells	Volatile Organics	Base-Neutral-Acid Organics	PCBs	Total Metals	Dissolved Metals	TPH (418.1)	TPH (8015)
CP-103-A	X	X	-	X	X	X	X
CP-103-B	X	X	-	X	X	X	X
CP-104-A	X	X	X	X	X	X	X
CP-105-A	X	X	-	X	X	X	X
CP-105-B	X	X	-	X	X	X	X
CP-106	X	X	-	X	X	X	X
CP-107	X	X	-	X	X	X	X
CP-108-A	X	X	X	X	X	X	X
CP-108-B	X	X	-	X	X	X	X
CP-109	X	X	-	X	X	X	X
CP-110	X	X	X	X	X	X	X
W-10	X	X	X	X	X	X	X
New Monitoring Wells	Volatile Organics	Base-Neutral-Acid Organics	PCBs	Total Metals	Dissolved Metals	TPH (418.1)	TPH (8015)
CP-111	X	X	-	X	X	X	X
CP-112	X	X	-	X	X	X	X
CP-113	X	X	X	X	X	X	X
CP-114	X	X	-	X	X	X	X
CP-115	X	X	X	X	X	X	X
CP-116	X	X	X	X	X	X	X
CP-117	X	X	X	X	X	X	X
CP-118	X	X	X	X	X	X	X
CP-119	X	X	X	X	X	X	X
CP-120	X	X	X	X	X	X	X

Notes:

- 1) (X) indicates analyses to be performed.
- 2) (-) indicates analyses not to be performed.
- 3) Refer to Table C-3 for reference methods and analytical laboratories.
- 4) Refer to Figure C-1 for sample locations.

10 SAMPLE LABELING, SHIPPING, AND CHAIN-OF-CUSTODY

10.1 Sample Labeling

Sample container labels will be completed immediately prior to or immediately following sample collection. Container labels will include the following information:

- Project Name
- Coded Sample Number
- Initials of Collector
- Date and Time of Collection.

10.2 Sample Shipping

Soil and water samples will be shipped to the appropriate analytical laboratory (listed below) with the following procedure:

- Sample containers will be transported on ice in a sealed ice chest or other suitable container
- Glass bottles will be separated in the shipping container by absorbent material to prevent breakage
- Ice will be placed in separate plastic bags and sealed
- All sample shipments will be accompanied by a Chain-of-Custody Laboratory Analysis Request Form. The completed Chain-of-Custody form will be enclosed in a plastic bag and taped to the inside lid of the cooler

- Signed and dated Chain-of-Custody seals will be placed on all coolers prior to shipping
- The consultant's office, name, and address will be placed on the shipping container.

Soil and water samples will be delivered to the analytical laboratories listed below for chemical testing:

- Columbia Analytical Services, Inc.
1317 South 13th Avenue
Kelso, Washington 98626
(206) 577-7222
 - Samples to be analyzed for total metals, TCLP TOX metals (soils only), and dissolved metals (waters only).
- Chempro Analytical Laboratory
2203 Airport Way South, Suite 400
Seattle, Washington 98134
(206) 223-0500
 - Samples to be analyzed for VOCs and PCBs.
- Analytical Resources, Inc.
333 Ninth Avenue
Seattle, Washington 98109-5187
(206) 621-6490
 - Samples to be analyzed for BNAs and TPH.

Soil samples will be delivered to the following laboratory for engineering properties analysis:

- Hong West and Associates, Inc.
18908 Highway 99
Lynnwood, Washington 98046
(206) 774-0106
 - Samples to be analyzed for grain size distribution (sieve and hydrometer analysis),

content and, where appropriate, Atterberg Limits.

10.3 Chain-of-Custody

Once a sample is collected it will remain in the custody of the sampler or other SE/E personnel until shipment to the laboratory. Upon transfer of sample possession to subsequent custodians, a Chain-of-Custody Form will be signed by the persons transferring custody of the sample container. Signed and dated Chain-of-Custody seals will be placed on all coolers prior to shipping. Upon receipt of samples at the laboratory, the shipping container seal will be broken and the condition of the samples will be recorded by the receiver. Chain-of-Custody records will be included in the analytical report prepared by the laboratory.

11 WATER LEVEL MEASUREMENTS

Two rounds of water level measurements will be obtained from the 13 existing wells on-site or adjacent to the site, and the 10 new wells. Water levels will be measured prior to water sampling and a few weeks after sampling. These data will be used to evaluate flow directions in the uppermost aquifer and vertical gradients. Depth-to-water measurements will be obtained using an electric water level detector (Olympic Well Probe; Model 300 or equivalent). Water levels in monitoring wells will be measured to the nearest 0.01 foot from a surveyed notch at the top of the PVC casing. Measurements will include date, time, and initials of the recorder. Water level measurements taken for a single data set will be obtained over as short a period as possible to reduce the potential influence of water level fluctuations.

12 HYDRAULIC CONDUCTIVITY TESTING

To further characterize the range of horizontal hydraulic conductivity within the shallow aquifer, rising head slug tests will be performed in each new monitoring well following development. Slug tests will utilize a PVC bailer to remove a slug of ground water and an electric water level indicator or a pressure transducer and an electronic data logger to measure water level response. Measurements will be analyzed using methods described by Hvorslev (1951) or other appropriate techniques.

All water collected during slug testing will be stored in appropriate containers provided by Chempro. Each container will be clearly marked on the top and side with the type and the source of the contents. The water will be stored until sampling results are obtained and then disposed of by Chempro.

PART D
RISK ASSESSMENT

1 PURPOSE

Risk assessment is a procedure for estimating the extent to which the release or threat of release may pose a threat to public health or welfare or the environment. The requirement for conducting a baseline risk assessment (BRA) as part of RCRA facility investigation as referenced under CERCLA is described in 40 CFR Part 300, Subpart F, Section 300.68. The BRA consists of an evaluation of potential risks to human health that are associated with a site to assist in the selection of a remedial alternative for the site and prior to implementing remedial activities. This BRA will include a quantitative public health evaluation and a qualitative environmental evaluation. This work plan describes the approach and methods that will be used for the risk assessment at the Chempro Pier 91 facility.

Indicator chemicals are selected so that the BRA focuses on the chemicals of concern at a site. Chemicals that have been observed at the Chempro Pier 91 facility includes chlorinated organic compounds, non-chlorinated organic compounds, and benzene. A review of chemical data collected during the phase I and phase II hydrogeologic investigations will be conducted to select indicator chemicals. The selection process permits a focused study of the chemicals that pose the greatest risk to human health or the environment. The toxicological properties associated with these chemicals of concern are then reviewed. Exposure routes and populations at risk are identified, and finally, the potential risks from the site are characterized.

The BRA will consist of a hazard identification, dose-response assessment, exposure assessment, and risk characterization. All calculations, assumptions, and methodologies used in the risk assessment process will be consistent with U.S. EPA guidelines (U.S. EPA, March 1989; July 1989a; July 1989b; October 1989). The scope of work will include the tasks described in this work plan. In preparing this scope of work, it was assumed that air, ground water, or fate and transport modeling will not be included.

2 HAZARD EVALUATION

The BRA will address the potential for health risks to on- and off-site receptors. The BRA will evaluate the incremental risks associated with only those chemicals that may have originated at the site. All data gathered from the site will be reviewed and evaluated to allow selection of indicator chemicals. This review will include ground water and soil data collected during the phase I and phase II hydrogeologic investigations at the Chempro Pier 91 facility. Up to six indicator chemicals will be selected based on concentration, detection frequency, toxicity, mobility, and/or persistence. Indicator chemicals will therefore consist of those substances that have high potential toxicity, are representative of the range of structural compound classes present at the site, and tend to persist in various media.

3 TOXICITY ASSESSMENT

Information on the toxicity of the indicator chemicals will be used with the results of the exposure assessment to characterize the potential risks to potential receptors. The toxicological properties of each indicator chemical will be reviewed and discussed, with emphasis on the potential acute and chronic toxicity, developmental/reproductive toxicity, and carcinogenicity. Qualitative aspects of the range of target organs and toxic effects, and quantitative aspects of dose-response variables that are used to estimate risk will also be examined. A discussion of federal and state regulations and criteria will be included.

Regulatory guidelines differentiate between carcinogenic and non-carcinogenic effects of chemicals. For non-carcinogens, a threshold of exposure is assumed, below which no adverse human health effects are expected to occur. Reference doses (RfDs) for chronic exposure are developed by the U.S. EPA, and are chemical-specific, exposure-specific doses (i.e., inhalation, ingestion) to which nearly all populations may be exposed for a period of up to 365 days per year for 70 years without experiencing adverse health effects. Non-carcinogenic chronic health effects will be evaluated through a comparison of a chemical's estimated intake to its respective RfD.

For carcinogens, the U.S. EPA assumes that exposure presents some increased risk of developing cancer to an individual. The potential cancer risk associated with exposure to a carcinogenic chemical will be calculated by multiplying the dose from a specific route of exposure by a carcinogenic potency factor (CPF) or potency slope. The CPF is a value established by the U.S. EPA for most potential or known carcinogens, and are chemical-specific and exposure route-specific. This value represents the relative carcinogenic potency of a chemical and is usually based on laboratory animal or epidemiological studies. The EPA usually derives CPFs from the upper 95 percent confidence limit of the slope of the extrapolated dose-response curve. This curve is the relationship between a dose and tumor incidence. As a result, the risk characterization will give an upper-bound

estimate of the potential risk associated with exposure to a carcinogenic chemical.

Because of these differences, characterization of non-carcinogenic and carcinogenic risks from exposures to indicator chemicals will be conducted separately. For chemicals that lack critical toxicity values specified by the US EPA, existing studies and extrapolation methods may be reviewed and used to develop RfDs and CPFs. The likelihood of adverse effects will be evaluated to the extent permitted by the data. All uncertainties in this approach will be outlined in the report. All estimated risks for the indicator chemicals associated with the site will reflect the most current U.S. EPA verified critical toxicity values.

4 EXPOSURE ASSESSMENT

Exposure assessment is an estimate of the magnitude, frequency, duration, and route of exposure of the indicator chemicals identified during the hazard assessment. Chemical intakes or doses will be calculated for exposures to the indicator chemicals, and the assumptions used (i.e., inhalation rates, adsorption factors) will be documented in the BRA report. The assumptions selected will represent a typical exposure case and reasonable maximum exposure for each of the scenarios selected. These dose estimates will then be combined with dose-response variables from the toxicity assessment to derive estimates of health risks during the risk characterization task. The exposure assessment will involve the following tasks:

1. Identify and characterize human populations that may be exposed to soils, fugitive dusts or vapors, and ground water that may contain hazardous substances. Potential receptors will include both on-site workers and off-site human populations.
2. Identify and evaluate exposure pathways to exposed populations from on-site soils and ground water that may contain hazardous substances. Environmental fate and transport of the indicator chemicals will be assessed for all identified pathways. Exposure pathways previously assessed will be addressed (i.e., sources of indicator chemicals and the mechanism for their release, such as potential air entrainment of chemical-laden surface soils); environmental transport media, such as ground water will be discussed; actual or potential points of contact will be identified; and routes of exposure will be evaluated.
3. Estimate chemical concentrations at points of exposure. Points of exposure may consist of on-site soils, ground water, and air that may contain hazardous substances. Exposure point concentrations in air will be based on available on- and

off-site air monitoring. Estimated and measured exposure point concentrations will be compared with applicable, or relevant and appropriate requirements promulgated by the U.S. EPA, the State of Washington and local public health agencies.

4. Estimate intake rates in humans. Intake rates will be expressed as mg/kg body weight/day and will be calculated by integrating the results of the exposed population analysis, the route of exposure analysis, and the exposure point concentration calculations. Intake rates of potential human receptors will be based on U.S. EPA recommended exposure factors (U.S. EPA, July 1989a) and will be calculated separately for exposures to indicator chemicals in soils and water.

5 RISK CHARACTERIZATION

Once the indicator chemicals, their toxicity, and potential exposure pathways are identified, the risks associated with such exposures will be characterized (i.e., the likelihood of an impact or threat occurring and the extent of the expected impact or threat). The risk characterization will incorporate acceptable levels of exposure based on toxicological literature and regulatory criteria. The likelihood of carcinogenic and non-carcinogenic effects due to exposure to the indicator chemicals will be considered separately.

For non-carcinogens, a Hazard Index (HI) will be estimated. If the HI is greater than one, a potential health risk may exist. For carcinogens, the exposure dose and CPF will be multiplied to estimate the potential carcinogenic risk. The calculated carcinogenic risk will then be compared to the acceptable risk range of 10^{-4} to 10^{-7} established by the U.S. EPA.

Potential cumulative health risks associated with exposures to multiple chemicals in various exposure media will be estimated by summing the risks for both contaminants within a medium, and then summing the risks across all potential exposure media. Interpretation of health risks will be based on comparisons with generally accepted risk levels.

6 ENVIRONMENTAL EVALUATION

A qualitative environmental evaluation will also be prepared. Exposure and toxicity information will be combined to evaluate potential environmental impacts associated with the indicator chemicals. The environmental evaluation will consist of a discussion of the chemicals of concern, receptor characterization, and potential exposure pathways.

7 UNCERTAINTY ANALYSIS

The uncertainty analysis will discuss uncertainties in the final risk estimates due to uncertainties in the dose-response relationships and in estimated exposures and human intake levels. Qualitative discussions of uncertainties in the estimates and assumptions used in the BRA will be provided. The uncertainty analysis will include the following: key exposure parameters; environmental sampling and analysis; toxicological data; and the major assumptions and judgements made for the BRA.

8 REPORT

A BRA report summarizing the results of both the public health evaluation and the environmental evaluation will be prepared. Each step of the public health evaluation 1) Hazard Evaluation, 2) Toxicity Assessment, 3) Exposure Assessment, 4) Environmental Evaluation, 5) Uncertainty Analysis will be documented. This report will serve as a companion document to the RFI report. The risk assessment, in conjunction with the RFI data, will be used to determine if the Action Level is exceeded, and therefore determine if a Corrective Measures Study is warranted.

PART E

PROJECT DELIVERABLES AND SCHEDULE

1 DELIVERABLES AND SCHEDULE

1.1 Deliverables

The deliverables and schedule for this RFI Study include the following:

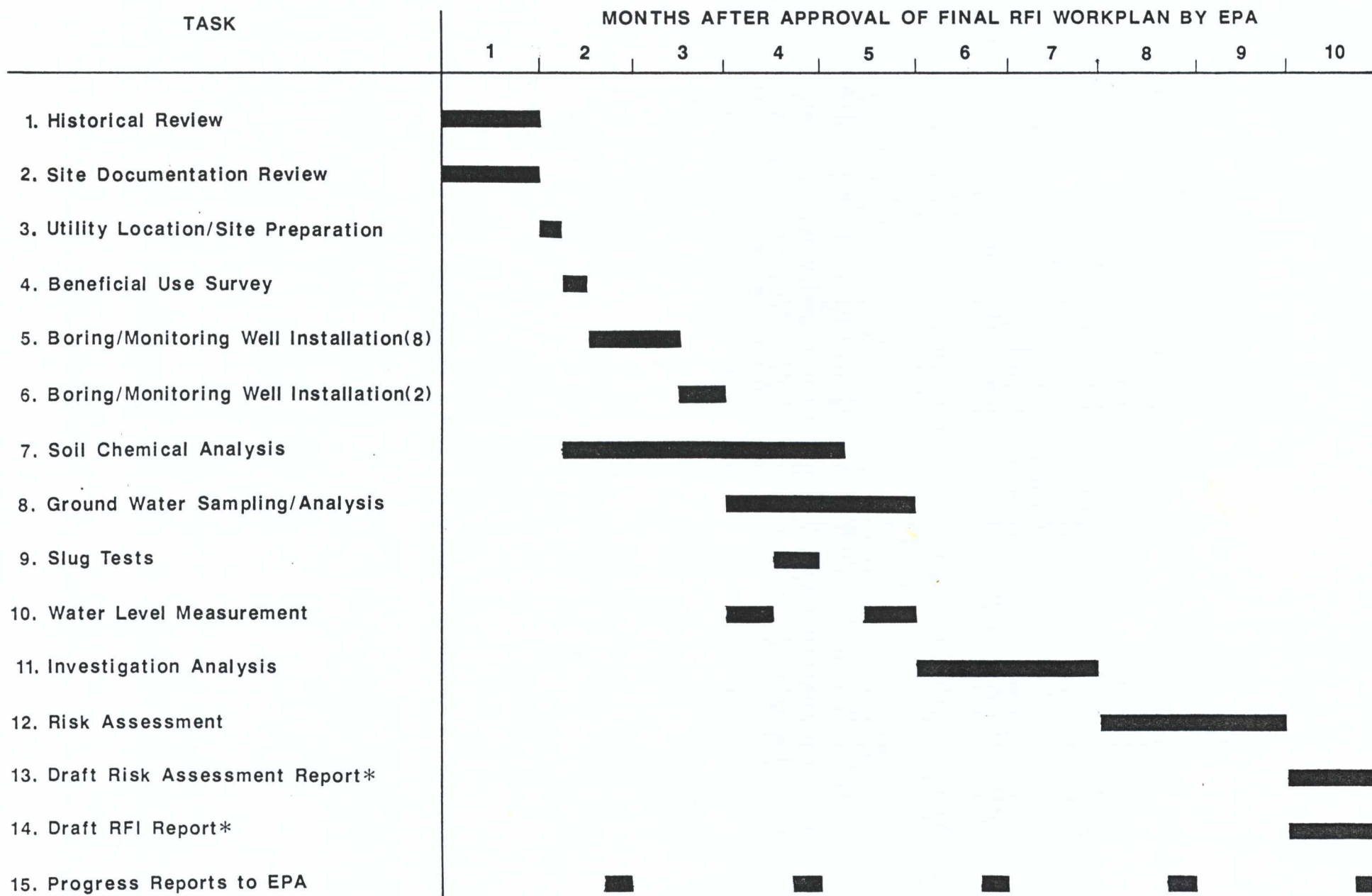
- Draft RFI report (summarizing RFI activities and analysis) 30 days after completion of field activities and investigation analysis
- Draft risk assessment report summarizing the baseline risk assessment
- Progress reports bimonthly summarizing RFI activities, concerns, and issues
- Final RFI report 30 days after receipt of EPA comments on draft report
- Final risk assessment report 30 days after receipt of EPA comments on draft report

1.2 Schedule

The schedule for field work and reporting is illustrated on Figure E-1. Each time period illustrated represents a standard one-month calendar.

Each field task identified in the Part C Sampling Plan has been identified. In addition, project deliverables (as they can be projected) are also identified.

PROPOSED RFI SCHEDULE



* Final reports will be submitted 30 days after receipt by SE/E of EPA's comments.

SIGNATURE PAGE

Approvals:

Anita Lovely
SE/E Quality Assurance Coordinator

Date

SE/E Data Management Coordinator

Date

Chempro QA Officer/Data Management Officer

Date

Dennis Goldman
SE/E Project Director

Date

Susan Donahue
Chempro Project Manager

Date

U.S. EPA Region X Quality Assurance Officer

Date

1 INTRODUCTION

An important part of effective multidisciplinary field investigation programs is a definitive quality assurance (QA) program coupled with efficient utilization of personnel and physical resources. A comprehensive and well-documented QA program is required to obtain data that are scientifically and legally defensible, and to meet the requisite levels of precision and accuracy with minimum expenditure of resources.

This section addresses quality assurance/quality control (QA/QC) considerations and guidelines for the field and laboratory work to support the RCRA facility investigation at the Chemical Processors, Inc. (Chempro) Pier 91 facility in Seattle, Washington.

The procedures and guidelines outlined in this document are based on the Sweet-Edwards/EMCON, Inc. (SE/E) standard QA/QC program and are consistent with Quality Assurance Interim Guidelines for Water Quality Sampling and Analysis (Washington Department of Ecology, December 1986) and Development of an RFI Work Plan and General Considerations for RCRA Facility Investigations (U.S. EPA, May 1989). The QA goals of this project are to:

- Collect high-quality, verifiable data
- Ensure cost-effective use of resources
- Ensure that data are usable by Chempro and the United States Environmental Protection Agency (U.S. EPA).

2 PROJECT DESCRIPTION

The goal of the hydrogeologic study (Phase III) is to supplement existing data collected by Sweet-Edwards/EMCON (SE/E) during two previous investigations conducted at the Chemical Processors, Inc. (Chempro) facility located at Pier 91 in Seattle, Washington. The primary objectives are to:

- Identify site historical uses which would impact the scope of this investigation.
- Identify potential populations at risk (e.g., beneficial use survey).
- Evaluate sources of release and potential release of hazardous waste or constituents.
- Determine the nature and extent of hazardous substances in ground water and soil on the facility.

The findings of this investigation, coupled with information collected during the past investigations will be used to meet the requirements of a RCRA facility investigation (RFI) as mandated under a 3008 Order and as defined under EPA guidance.

General procedures and guidelines for field activities are included in Part C (Sampling Plan) of this document. The Quality Assurance Project Plan (QAPP) forms a system to promote high quality data, and to evaluate and verify collected data.

The proposed program includes a review of historical site records, a review of operational site records, a beneficial use survey, 10 shallow soil borings with monitoring well installations, the collection of 20 soil samples for chemical and engineering testing, the collection of ground water samples from 23 monitoring wells, conducting in-situ hydraulic conductivity tests, measuring water level elevations, data evaluation, and report preparation.

3 PROJECT ORGANIZATION AND RESPONSIBILITIES

Project organization and the individuals responsible for ensuring the quality of the field operations and data collected are shown in Figure F-1. The responsibilities of these personnel are summarized in Table F-1.

Figure F-1

QA PROJECT ORGANIZATION

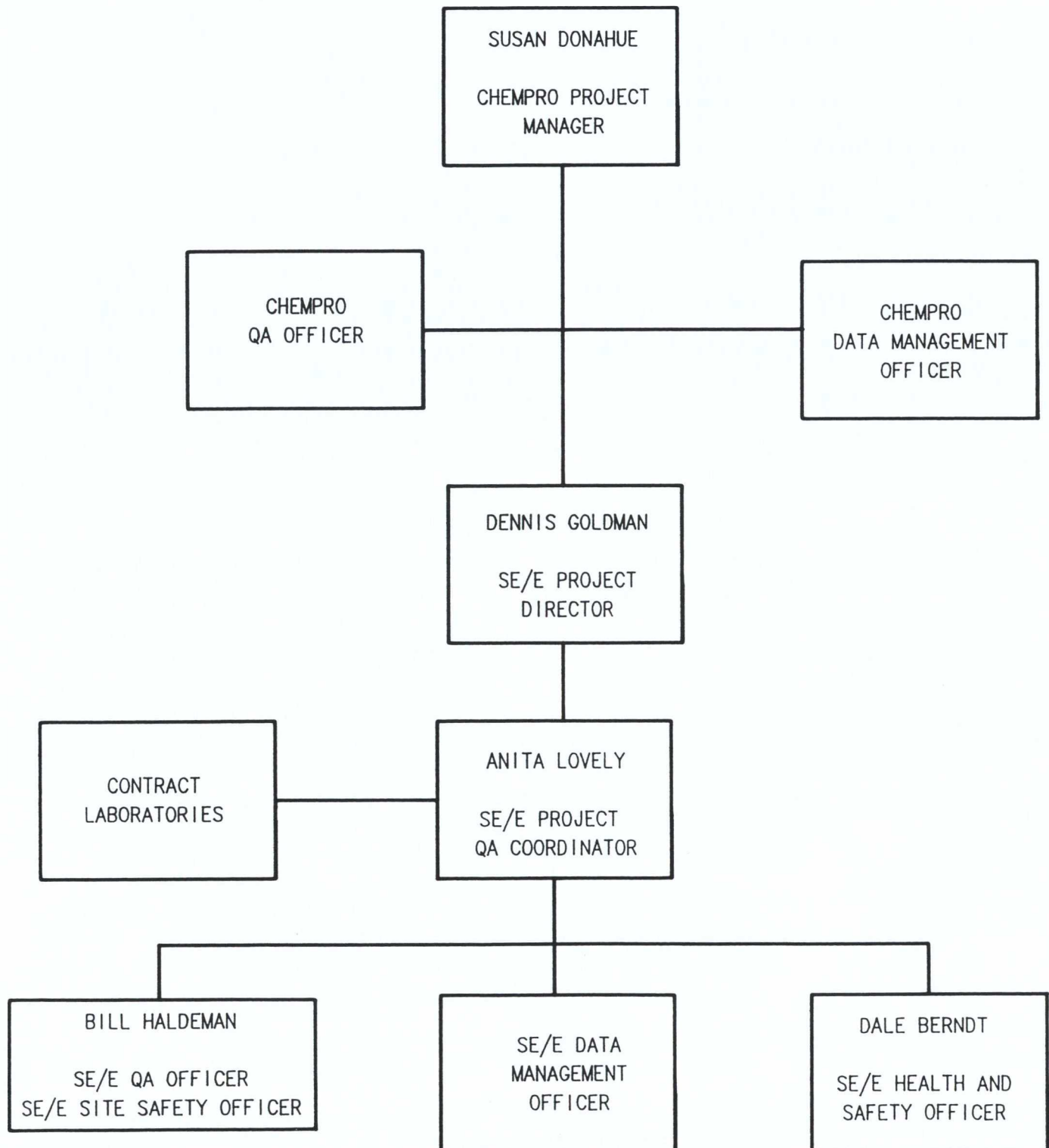


Table F-1

PERSONNEL RESPONSIBILITIES FOR QUALITY ASSURANCE

Personnel	Responsibilities
Chempro Project Manager	Provide oversight of all program activities. Review final project QA objectives, needs, problems, and requests. Approve appropriate QA corrective actions as needed.
Chempro Quality Assurance Officer	Provide approval for analytical procedures and QA/QC project plan, ensuring compliance with U.S. EPA QA/QC policies. Provide coordination between Chempro and SE/E for field operations and Chempro analytical services.
Chempro Data Management Officer	Provide oversight of data management activities (e.g., review of chain-of-custody forms) conducted by SE/E to ensure proper handling of data.
SE/E Project Director	Oversee project performance and provide technical expertise to accomplish project objectives. Ensure that project tasks are successfully completed within the projected time periods.
SE/E Project QA Coordinator/ Data Management Coordinator	Provide technical QA assistance on-site to accomplish project objectives. Provides coordination between SE/E field activities and all analytical services.
SE/E QA Officer, Site Safety Officer	Conduct field sampling operations in accordance with approved sampling and analysis plan. Ensure that all QA protocols (including chain-of-custody documentation, sample collection and labeling, sample storage and shipping, instrument calibration) are followed as required. Recognize and implement necessary corrective actions. Document field operations. Ensure that health and safety guidelines are followed to avoid any compromise of sample integrity. Document any health and safety issues that may affect sample collection.
SE/E Health and Safety Officer	Provide technical assistance as required to resolve on-site health and safety issues requiring corrective action. Prepare Health and Safety Project Plan.
Analytical Laboratory	Provide analytical support. Perform all required QC sample analyses including analytical duplicates, blanks, matrix spikes, performance materials. Initiate and document required corrective action. Perform preliminary review of data for completeness, and for transcription or analytical error. Follow US EPA guidelines for methods and QA/QC policies.

4 OBJECTIVES FOR MEASUREMENT

The overall QA objective for measurement data is to ensure that data of known and acceptable quality are provided. All measurements will be made to yield accurate and precise results representative of the media and conditions measured. All data will be calculated and reported in units consistent with those of other agencies and organizations to allow comparability of databases.

QA objectives for precision, accuracy, and completeness have been established for each measurement variable, where possible, and are presented in Tables F-2 and F-3.

Table F-2
OBJECTIVES FOR MEASUREMENT DATA

Variable	Matrix	Units	Quantitation Limits	Accuracy	Precision	Completeness	Method	Reference	Bottle ^a	Preservation Maximum Holding Time ^b
Volatiles	Solids	ug/kg ^c	e	±30%	±30%	95%	Purge + trap/	SW-846	SV	14 days
Water		ug/L	e	±10%	±20%	95%	GC/MS		WV	
Semivolatiles	Solids	ug/kg ^c	e	±30%	±30%	95%	Extraction/	SW-846	SN	7 days/40 days
Water		ug/L	e	±10%	±20%	95%	GC/MS		WN	after extraction
PCBs	Solids	ug/kg ^c	e	±30%	±30%	95%	Extraction/	SW-846	SN	7 days/40 days
Water		ug/l	e	±10%	±20%	95%	GC/ECD		WN	after extraction
Metals	Solids	ug/kg ^c	e	±30%	±30%	95%	ICP, AA	SW-846	SM	6 months
Water		ug/L	e	±10%	±20%	95%	CVAA		WM	(Hg-28 days)

^a See Table F-4 for type of containers and preservation.

^b Where two times are given, the first refers to the maximum time prior to extraction, the second to the maximum time prior to instrumental analysis. The U.S. EPA SW-846 holding times will be adequate to meet these overall maximum holding times.

^c Dry-weight basis.

^d The detection limits for solid matrices are based on the EPA wet-weight detection limits. Detection limits will be elevated when reported on a dry-weight basis and if matrix interferences are a problem.

^e The practical quantitation limits using the procedures specified in Chapter 2 of SW-846 are provided in Table F-3. Actual quantitation units will be matrix-dependent.

^f Accuracy can be measured on a daily basis using percent recovery from a matrix spike analysis.

^g Precision can be measured on a daily basis using relative percent difference from a matrix spike/matrix spike duplicate analysis.

Table F-3
RECOMMENDED QUANTITATION LIMITS

(Page 1 of 3)

Analyte	Method	Technique	Quantitation Limits ^{a,b}		Analyte	Method	Technique	Quantitation Limits ^a	
			Low Soil ^c (mg/kg)	Water (mg/l)				Low Soil ^c (mg/kg)	Water (mg/l)
<u>Volatile Organics</u>									
Chloromethane	8240	GC-MS	0.010	0.010	2-Chloroethyl Vinyl Ether	8240	GC-MS	0.010	0.010
Bromomethane			0.010	0.010	Bromodichloromethane			0.005	0.005
Vinyl Chloride			0.010	0.010	Trichlorofluoromethane			0.005	0.005
Chloroethane			0.010	0.010	1,2-Dichloropropane			0.005	0.005
Methylene Chloride			0.005	0.005	cis-1,3-Dichloropropene			0.005	0.005
Acetone			0.100	0.100	Trichloroethene			0.005	0.005
Carbon Disulfide			0.005	0.005	Dibromochloromethane			0.005	0.005
1,1-Dichloroethene			0.005	0.005	1,1,2-Trichloroethane			0.005	0.005
1,1-Dichlorethane			0.005	0.005	Benzene			0.005	0.005
trans-1,2-Dichloroethene			0.005	0.005	trans-1,3-Dichloropropene			0.005	0.005
cis-1,2-Dichloroethene ^d			0.005	0.005	Bromoform			0.005	0.005
1,2-Dichlorethane (total) ^d			0.005	0.005	4-Methyl-2-pentanone			0.050	0.050
Chloroform			0.005	0.005	2-Hexanone			0.050	0.050
1,2-Dichlorethane			0.005	0.005	Tetrachloroethene			0.005	0.005
2-Butanone			0.100	0.100	Toluene			0.005	0.005
1,1,1-Trichloroethane			0.005	0.005	Chlorobenzene			0.005	0.005
Carbon Tetrachloride			0.005	0.005	1,1,2,2-Tetrachloroethane			0.005	0.005
Vinyl Acetate			0.050	0.050	1,1,2-Trichloro-1,2,2-trifluoroethane ^d			0.005	0.005
Ethylbenzene			0.050	0.050					
Styrene			0.005	0.005					
Xylenes (total)			0.005	0.005					
<u>Semivolatile Organics</u>									
Phenol	8270	GC-MS	0.600	0.010	Hexachloroethane	8270	GC-MS	0.660	0.010
bis-(2-Chloroethyl) ether			0.660	0.010	Nitrobenzene			0.660	0.010
2-Chlorophenol			0.660	0.010	Isophorone			0.660	0.010
1,3-Dichlorobenzene			0.660	0.010	2-Nitrophenol			0.660	0.010
1,4-Dichlorobenzene			0.660	0.010	2,4-Dimethylphenol			0.660	0.010
Benzyl alcohol			1.300	0.020	Benzoic acid			3.300	0.050
1,2-Dichlorobenzene			0.660	0.010	bis(2-Chloroethoxy)methane			0.660	0.010
2-Methylphenol			0.660	0.010	2,4-Dichlorophenol			0.660	0.010
bis(2-Cholorisopropyl)ether			0.660	0.010	1,2,4-Trichlorobenzene			0.660	0.010
4-Methylphenol			0.660	0.010	Naphthalene			0.660	0.010

Table F-3
RECOMMENDED QUANTITATION LIMITS

(Page 2 of 3)

Analyte	Method	Technique	Quantitation Limits ^{a,b}		Analyte	Method	Technique	Quantitation Limits ^a	
			Low Soil ^c (mg/kg)	Water (mg/l)				Low Soil ^c (mg/kg)	Water (mg/l)
<u>Semivolatile Organics (continued)</u>									
N-Nitroso-di-n-dipropylamine			0.660	0.010	4-Chloroaniline			1.300	0.020
Hexachlorobutadiene			0.660	0.010	Hexachlorobenzene			0.660	0.010
4-Chloro-3-methylphenol (para-chloro-meta-cresol)			1.300	0.020	Pentachlorophenol			3.300	0.050
2-Methylnaphthalene			0.660	0.010	Phenanthrene			0.660	0.010
Hexachlorocyclopentadiene			0.660	0.010	Anthracene			0.660	0.010
2,4,6-Trichlorophenol			0.660	0.010	Di-n-butylphthalate			0.660	0.010
2,4,5-Trichlorophenol			0.660	0.010	Fluoranthene			0.660	0.010
2-Chloronaphthalene			0.660	0.010	Pyrene			0.660	0.010
2-Nitroaniline			3.300	0.050	Butylbenzylphthalate			0.660	0.010
Dimethylphthalate			0.660	0.010	3,3'-Dichlorobenzidine			1.300	0.020
Acenaphthylene			0.660	0.010	Benzo(a)anthracene			0.660	0.010
2,6-Dinitrotoluene			0.660	0.010	Chrysene			0.660	0.010
3-Nitroaniline			3.300	0.050	bis(2-Ethylhexy)phthalate			0.660	0.010
Acenaphthene			0.660	0.010	Di-n-octylphthalate			0.660	0.010
2,4-Dinitrophenol			3.300	0.050	Benzo(b)fluoranthene			0.660	0.010
4-Nitrophenol			3.300	0.050	Benzo (k) fluoranthene			0.660	0.010
Dibenzofuran			0.660	0.010	Benzo(a)pyrene			0.660	0.010
2,4-Dinitrotoluene			0.660	0.010	Indeno(1,2,3-cd)pyrene			0.660	0.010
Diethylphthalate			0.660	0.010	Dibenz(a,h)anthracene			0.660	0.010
4-Chlorophenol phenyl ether			0.660	0.010	Benzo(g,h,i)perylene			0.660	0.010
Fluorene			0.660	0.010					
4-Nitroaniline			3.300	0.050					
4,6-Dinitro-2-methylphenol			3.300	0.050					
N-nitrosodiphenylamine			0.660	0.010					
4-Bromophenyl phenyl ether			0.660	0.010					
<u>PCBs</u>									
Aroclor-1016	8080	GC-ECD	0.033	0.001	Aroclor-1248	8080	GC-ECD	0.033	0.001
Aroclor-1221			0.033	0.001	Aroclor-1254			0.033	0.001
Aroclor-1232			0.067	0.002	Aroclor-1260			0.033	0.001
Aroclor-1242			0.033	0.001					

Table F-3
RECOMMENDED QUANTITATION LIMITS
 (Page 3 of 3)

Analyte	Method	Technique	Quantitation Limits ^{a,b}		Analyte	Method	Technique	Quantitation Limits ^a	
			Soil ^e (mg/l)	Water (mg/l)				Soil ^e (mg/l)	Water (mg/l)
Arsenic	7060/ 6010	Graphite Furnace AA	0.5	0.010	Lead	7420/ 7421/ 6010	Flame AA	0.5	0.005
Beryllium	7090/ 6010	AA/ICP	N/A	0.005	Mercury	7470/ 6010	Cold vapor	0.02	0.002
Barium	7080/ 6010	AA/ICP	0.5	0.200	Nickel	7520/ 6010	AA/ICP	N/A	0.040
Cadmium	7130/ 6010	AA/ICP	0.1	0.005	Zinc	6010	AA/ICP	N/A	0.020
Chromium	7190/ 6010	AA/ICP	0.5	0.010					
Copper	7210/ 6010	AA/ICP	N/A	0.025					

^a The listed quantitation limits are derived from "Test Methods for Evaluating Solid Waste," SW-846 US EPA (November 1986) and from U.S. EPA Contract Laboratory Program (U.S. EPA, 1989).

^b Specific quantitation limits are highly matrix dependent. The quantitation limits listed herein are provided for guidance and may not always be achievable.

^c Quantitation limits listed for soil/sediment are based on wet weight. The quantitation limits calculated by the laboratory for soil/sediment, calculated on dry weight basis as required, therefore PQLs will be higher based on the percent moisture in each sample. These quantitation limits are the limits for the actual soil digest limits. Measured concentrations will be reported on a dry weight basis.

^d Compound is not included in the SW-846 list of compounds (Methods 8240 and 8270), and practical quantitation limits (PQLs) are not specified. The PQL shown is an estimate based on previous laboratory reports which included these compounds (SE/E, 1989).

^e Analysis performed on Toxicity Characteristic Leaching Procedure (TCLP) extract (40 CFR Part 261 et al).

5 SAMPLING PROCEDURES

Detailed procedures and protocols for site selection and sample collection, handling, preservation, shipping, and storage are included in the sampling plan (Part C). Sample collection, handling, and preservation procedures are also summarized in Table F-4. Samples will be fully labeled as they are collected. Sample collection data, including label information, will be recorded on Field Sampling Data Sheets (see Figure F-2) as the samples are collected. Sample containers will be placed in a cooler on ice immediately following sample collection. Field duplicate samples will be clearly identified on the Field Sampling Data Sheet. Sample containers will be kept closed, maintained under custody, and refrigerated until analysis.

Any changes in the sampling procedures as outlined in either the sampling plan (Part C) or this Quality Assurance Project Plan will be documented in the field logbook (Section 15). The SE/E Project Director will be kept informed of any changes in sampling procedures.

Table F-4
SAMPLE CONTAINERS, PREPARATION, AND PRESERVATIVES

Preservation Bottle	Parameter Group	Container	Container Preparation	Preservation and Handling
<u>Soil/Sludge/Product^a</u>				
SV	Volatile organics	2-4-oz glass jar; PTFE ^b -lined silicon cap	Detergent wash, distilled water rinse, heated at 105° C for >1 h	Fill leaving <u>minimum air space</u> , keep in dark on ice (4° C)
SN	Extractable organics	One 8-oz glass jar; PTFE-lined lid	Detergent wash, distilled water rinse, kiln-fired at 450° C for >1 h or solvent-rinsed	Keep on ice (4° C)
SP	PCBs	8-oz glass jar; PTFE-lined lid	Detergent wash, distilled water rinse, kiln-fired at 450° C for >1 h or solvent-rinsed	Keep on ice (4° C)
SM	Metals	8-oz glass jar; PTFE-lined lid	Rinse in 20% HNO ₃ , distilled/-DI ^c rinse	Keep on ice (4° C)
<u>Water</u>				
WV	Volatile organics	Two 40-mL glass vials; PTFE-lined silicon septum caps	Detergent wash, distilled water rinse, heated at 105° C for >1 h	Fill leaving <u>no air space</u> , keep in dark on ice (4° C)
WN	Extractable Organics	Two 1-liter amber glass bottle PTFE-lined cap	Detergent wash, distilled water rinse, kiln-fired at 450° C for >1 h	Keep on ice (4° C)
WP	PCBs	Two 1-liter amber glass; PTFE-lined lid	Detergent wash, distilled water rinse, kiln-fired at 450° C for >1 h or solvent-rinsed	Keep on ice (4° C)
WM	Metals	1-L high-density polyethylene bottle; PTFE-lined cap	Rinse in 20% HN-O ₃ , distilled/ DI rinse	HNO ₃ to pH 2, keep on ice
F	pH	150-ML beaker	Detergent wash, distilled water rinse	In situ

^a Each product sample will be collected in one 8-oz glass jar with PTFE-lined cap

^b PTFE = polytetrafluoroethylene

^c DI = deionized water

Note: 5% of samples will be taken in duplicate and specified for use as matrix spike duplicates



Sweet-Edwards/EMCON, Inc.

18912 North Creek Parkway, Suite 210 • Bothell, WA 98011
Office (206) 485-5000 • FAX (206) 486-9766

Field Sampling Data

LOCATION/ADDRESS _____
PROJECT NAME _____ # _____
CLIENT/CONTACT _____Well or Surface Site Number _____
Sample Designation _____
Date, Time _____
Weather _____

HYDROLOGY MEASUREMENTS:

(Nearest .01 ft.)

Elevation

Date, Time

Method Used (M-Scope Number or Other)

WELL EVACUATION:

Gallons

Pore Volumes

Method Used

Rinse Method

Date, Time

Surface Water Flow Speed _____ Measurement Method _____ Date, Time _____

SAMPLING:

Sample	Date, Time	Method	Volume (ml)	Container Type	Depth Taken (feet)	Field Filtered (yes,no)	Preservative	Iced (yes,no)	Sampler Cleaning Method
_____	_____	_____	_____	_____	_____	_____	_____	_____	Non-Phosphoric detergent wash
_____	_____	_____	_____	_____	_____	_____	_____	_____	H ₂ O rinse
_____	_____	_____	_____	_____	_____	_____	_____	_____	MeOH rinse
_____	_____	_____	_____	_____	_____	_____	_____	_____	Distilled H ₂ O rinse

FIELD WATER QUALITY TESTS:

Pore Vol.

Number

pH

Conductivity

Temp

Eh

NOTES:

Total # of Bottles: _____ Signature: _____

SEA-400-01

Sweet-Edwards
EMCONDATE 5-90
DWN: MLP
APPR. AL
REVIS. _____
PROJECT NO. S940705Figure F-2
CHEMPRO PIER 91 FACILITY
SAMPLING DATA FORM

6 SAMPLE CUSTODY

Sample custody is a vital aspect of field investigation programs that generate data for possible regulatory action or as evidence in a court of law. The samples must be traceable from the time of sample collection until the time the data are introduced as evidence in enforcement proceedings.

6.1 Field Sampling Operations

The key aspect of documenting sample custody is thorough record-keeping. Field sampling data sheets will be completed as samples are collected. All entries will be made in ink and any changes will be crossed out with a single line and initialed.

Sample containers will be labeled prior to the time of sampling with the following:

- Project code or number
- Sampling date and time
- Sample number
- Name of person sampling.

At the time of sampling, the appropriate sample containers will be selected, and the sample number for each subsample recorded on the summary sampling log. After each bottle is filled, the person sampling will initial the sample label to document proper sample handling, and a custody seal will then be completed and affixed to the bottle before it is placed in storage.

At the end of each sampling day and prior to the transfer of the samples off-site, chain-of-custody entries will be made for all samples, using the SE/E field sample data sheets. Information on the container labels will be double checked and samples will be recounted before leaving the sampling site.

6.2 Shipping

All samples will be accompanied by SE/E chain-of-custody/analysis request sheets (Figure F-3). Copies of all forms will be retained by SE/E.

Prior to shipping, each sample container will be placed in a plastic bag and securely packed inside the cooler. The original chain-of-custody forms (enclosed in plastic) will be taped to the inside lid of the cooler. The cooler will be closed, fiber tape wrapped completely around it, a "This End Up" label attached to both its sides, and a "Fragile-Glass" label attached to its top. A custody seal will be attached so that it must be broken when the cooler is opened. All samples collected will be packaged and shipped to designated laboratories according to U.S. Department of Transportation regulations.

6.3 Laboratory

The sample custodian at each laboratory will fill out the chain-of-custody record upon receipt of the samples and note the condition of each sample container received as well as questions or observations concerning sample integrity.


Sweet-Edwards / EMCON, Inc.

 Kelso, WA (206) 423-3580
 Bothell, WA (206) 485-5000
 Portland, OR (503) 624-7200

Chain of Custody / Laboratory Analysis Request

DATE _____ PAGE _____ OF _____

PROJECT _____ # _____ CLIENT INFO. _____ CONTACT _____ ADDRESS _____ TELEPHONE# _____ SAMPLERS NAME _____ PHONE# _____ SAMPLERS SIGNATURE _____					ANALYSIS REQUESTED <table style="width: 100%; font-size: small;"> <tr> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">BASE/NEU/ACID ORGAN.</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">GC/MS/625/8270</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">VOLATILE ORGANICS</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">GC/MS/624/8240</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">HALOGENATED VOLATILE</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">ORGANICS 601/8010</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">PHENOLICS</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">604/8040</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">POLYNUCLEAR</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">AROMATIC 610/8310</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">TOTAL ORGANIC CARBON</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">(TOC) 415/9060</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">TOTAL ORGANIC HALIDE</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">(TOX) 9020</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">EP TOX/TCLP METALS</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">(Circle One)</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">METALS (TOTAL)</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">(See Special Inst.)</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">TCLP ORGANICS</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">PH. COND</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">ALK</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">NO₃/NO₂ Cl</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">SO₄</td> <td style="writing-mode: vertical-rl; transform: rotate(180deg);">Ca, Mg, Na, K</td> </tr> </table>															BASE/NEU/ACID ORGAN.	GC/MS/625/8270	VOLATILE ORGANICS	GC/MS/624/8240	HALOGENATED VOLATILE	ORGANICS 601/8010	PHENOLICS	604/8040	POLYNUCLEAR	AROMATIC 610/8310	TOTAL ORGANIC CARBON	(TOC) 415/9060	TOTAL ORGANIC HALIDE	(TOX) 9020	EP TOX/TCLP METALS	(Circle One)	METALS (TOTAL)	(See Special Inst.)	TCLP ORGANICS	PH. COND	ALK	NO ₃ /NO ₂ Cl	SO ₄	Ca, Mg, Na, K	GENERAL CHEMISTRY (Specify)	OTHER (Specify)	NUMBER OF CONTAINERS
BASE/NEU/ACID ORGAN.	GC/MS/625/8270	VOLATILE ORGANICS	GC/MS/624/8240	HALOGENATED VOLATILE	ORGANICS 601/8010	PHENOLICS	604/8040	POLYNUCLEAR	AROMATIC 610/8310	TOTAL ORGANIC CARBON	(TOC) 415/9060	TOTAL ORGANIC HALIDE	(TOX) 9020	EP TOX/TCLP METALS	(Circle One)	METALS (TOTAL)	(See Special Inst.)	TCLP ORGANICS	PH. COND	ALK	NO ₃ /NO ₂ Cl	SO ₄	Ca, Mg, Na, K																							
SAMPLE I.D.	DATE	TIME	LAB I.D.	TYPE																																										
1.																																														
2.																																														
3.																																														
4.																																														
5.																																														
6.																																														
7.																																														
8.																																														

Relinquished By Sweet, Edwards & Assoc.		Relinquished By		Relinquished By		PROJECT INFORMATION		SAMPLE RECEIPT	
Signature		Signature		Signature		Shipping I.D. No.		Total No. of Containers	
Printed Name		Printed Name		Printed Name		VIA		Chain of Custody Seals	
Firm		Firm		Firm		Project		Received in good condition	
Date/Time		Date/Time		Date/Time		SPECIAL INSTRUCTIONS/COMMENTS		LAB NO.	
Received By		Received By		Received By					
Signature		Signature		Signature					
Printed Name		Printed Name		Printed Name					
Firm		Firm		Firm					
Date/Time		Date/Time		Date/Time					

DISTRIBUTION: WHITE - return to originator; YELLOW - lab; PINK - retained by originator.

S-E/E 400-05


**Sweet-Edwards
EMCON**

 DATE 5-90
 DWN. MLP
 APPR. AL
 REVIS. _____
 PROJECT NO. S940705

Figure F-3
CHEMPRO PIER 91 FACILITY

CHAIN OF CUSTODY/LABORATORY ANALYSIS REQUEST FORM

7 CALIBRATION PROCEDURES AND FREQUENCY

Calibration procedures, calibration frequency, and standards for measurement variables and systems will be in accordance with the U.S. EPA SW-846 requirements. Procedures for calibration of field equipment are described in the sampling plan (Part C).

8 ANALYTICAL PROCEDURES

Methods and references for most analyses are summarized in Table F-2. The U.S. EPA SW-846 methods will be utilized for the chemical analyses. The SW-846 requirements include routine analysis of liquid and solid environmental samples for organic and inorganic priority pollutants and Hazardous Substance List (HSL) compounds, using procedures based on the following U.S. EPA methods:

- U.S. EPA Method 624/8240; volatile compounds by gas chromatography/mass spectroscopy (GC/MS) (U.S. EPA 1984, 1986, 1987b)
- U.S. EPA Method 625/8270; semivolatile compounds by GC/MS (U.S. EPA 1984, 1987b)
- U.S. EPA Method 608/8080; organochlorine pesticides and PCBs by GC/MS (U.S. EPA 1984, 1987b).
- U.S. EPA Method Series 7000/6010; metals by atomic absorption spectroscopy and inductively coupled plasma (ICP) atomic emission spectroscopy (U.S. EPA 1986, 1987a).

Field measurements of pH will be performed according to U.S. EPA methods (U.S. EPA 1979) and instrument manufacturers instructions (see Appendix B).

9 INTERNAL QUALITY CONTROL CHECKS

The selected analytical laboratories will demonstrate the ability to produce acceptable results, using the modified methods recommended or their equivalent. The data will be evaluated by SE/E based on the following criteria (as appropriate for inorganic or organic chemical analyses):

- Performance on method tests (U.S. EPA 1979, 1984):
 - Matrix spike performance (DFTPP)
 - GC performance (tailing factors)
 - Blanks
 - Precision of calibration and samples
 - Linearity of response and linear range
- Percent recovery of internal standards
- Adequacy of detection limits obtained
- Precision of replicate analyses
- Comparison of the percentage of missing or undetected substances among replicate samples.

10 PERFORMANCE AND SYSTEM AUDITS

Performance and system audits for sampling and analysis operations consist of on-site review of field and laboratory QA systems and on-site review of equipment and methods for sampling.

Participating analytical laboratories are required to take part in a series of performance and systems audits conducted by the National Enforcement Investigations Center.

The Project Quality Assurance Coordinator (QAC), in conjunction with the U.S. EPA, will develop and conduct external system audits as required or requested. If required, performance evaluation audits will be conducted before the measurement system begins generating data. The audits will be repeated periodically as required by task needs, durations, and costs.

The Project QAC ensures that the QA officer has conducted adequate internal audits of performance and systems before submitting QA reports to the Program QAC.

11 PREVENTIVE MAINTENANCE

Preventive maintenance of equipment is essential if project resources are to be used cost-effectively. Preventive maintenance comprises 1) a schedule of preventive maintenance activities to minimize downtime and ensure accuracy of measurement systems and 2) availability of critical spare parts and backup systems and equipment. The preventive maintenance approach for specific pieces of equipment used in sampling, monitoring, and documentation will follow manufacturers' specifications and good field and laboratory practices. Performance of these maintenance procedures will be documented in the field logbooks.

12 DATA PRECISION, ACCURACY, AND COMPLETENESS

Routine procedures to be used for measuring precision and accuracy include use of replicate analyses, standard reference materials (SRMs), matrix spikes, and procedural blanks. Replicate matrix spikes and method blanks will be analyzed by the selected laboratories. Additional spikes and replicate analyses may be implemented. The minimum frequencies are as follows:

- Replicate analysis

Volatiles; metals; acid, base, and neutral organic compounds - 5 percent of samples will be analyzed as matrix spike duplicates. An additional blind replicate will be submitted for each waste type sampled.

- Matrix Spike

Trace metals; volatiles; acid, base, and neutral organic compounds -- one of every 20 samples will be spiked with selected target analytes and analyzed. If less than 20 samples are analyzed for a solid or liquid waste phase, at least one sample per waste phase will be spiked.

- Procedural blank

Trace metals; acid, base, and neutral organic compounds - one procedural blank will be analyzed for each extraction batch.

Volatiles - one procedural blank will be analyzed for each 12-hour shift.

The mean, \bar{C} , of a series of replicate measurements of concentration, C_i , for a given surrogate compound or analyte will be calculated as:

$$\bar{C} = \frac{1}{n} \sum_{i=1}^n C_i$$

where:

n = Number of replicate measurements.

The estimate of precision of a series of replicate measurements will usually be expressed as the relative standard deviation, RSD:

$$RSD = \frac{SD}{\bar{C}} \times 100\%$$

where:

SD = Standard deviation:

$$\sqrt{\frac{\sum_{i=1}^n (C_i - \bar{C})^2}{(n - 1)}}$$

Alternatively, for data sets with a small number of points (e.g., duplicate measurements), the estimate of precision may be expressed as a relative percent difference (RPD):

$$RPD = \frac{C_1 - C_2}{\bar{C}} \times 100\%$$

where:

C_1 = First concentration value measured for a variable
 C_2 = Second concentration value measured for a variable.

Accuracy as measured by matrix spike results will be calculated as:

$$\text{Recovery} = \frac{\Delta C}{C_s} \times 100$$

where:

ΔC = The measured concentration increase due to spiking
relative to the unspiked portion)

C_s = The known concentration increase in the spike.

Accuracy can also be measured by analysis of standard reference material (SRM) or regional reference material will be determined by comparing the measured value with the 95 percent confidence interval established for each analyte.

Completeness will be measured for each set of data received by dividing the number of valid measurements actually obtained by the number of valid measurements that were planned, as specified in the sampling plan (Part C).

13 CORRECTIVE ACTIONS

Corrective actions consist of 1) handling of analytical or equipment malfunctions and 2) handling of nonconformance or noncompliance with the established QA requirements. During field operations and sampling procedures, the field team leader will be responsible for correcting equipment malfunctions.

The QA officer is responsible for implementing corrective actions. Predetermined methods, limits of acceptability, and required sample handling are listed in Section F-6 and F-7. Any corrective action will be recorded by the QA officer and reported to the Project QAC officer. Corrective actions will be documented in the project file.

Analytical laboratories must adhere to good laboratory practices and standard operating procedure guidelines and specifications. When instrument response, quality control sample (SRM or matrix spike duplicate) precision or accuracy, or blank analyses indicate exceedance of control limits, corrective actions must be initiated before continuing with sample analysis.

14 QUALITY ASSURANCE REPORTS

QA reports will be submitted to U.S. EPA bi-monthly over the course of the project. QA reports will be submitted by the Project QAC to U.S. EPA within the time frame specified in the work plan.

The QA reports from the Project QAC will contain copies of the following information, where appropriate:

1. Well log
2. Sample log
3. Chain-of-custody forms
4. Packing lists

The completed forms will be accompanied by a technical memorandum from the Project QAC summarizing the reports and noting significant QA problems that arose during the reporting period.

Data and corresponding quality control information will be reported separately as the information is received. The handling and contents of the data reports are discussed in Section 15 (Data Management).

15 DATA MANAGEMENT

This section addresses issues related to data sources, data processing, and data evaluation. Raw data generated in the field or received from analytical laboratories will be validated in the office, entered into a computerized data base, and verified for consistency and correctness.

15.1 Field Data

Accurate documentation of field activities (e.g., pH measurements, conductivity measurements, field notes) will be maintained using field log books, field data forms, correspondence records, and photographic slides. Entries will be made in sufficient detail to provide an accurate record of field activities without reliance on memory.

Field log entries will be dated and include a chronologic description of task activities, names of individuals present, names of visitors, weather conditions, etc. All entries will be legibly entered in ink and initialed.

When photographs are taken, the project number, date, picture number, and description of the photograph will be entered on a photography log form (Figure F-4).

SE/E's Field Sampling Data forms will be used during soil and water sampling for this study. These sheets provide documentation of the following information:

- Project name
- Coded sample number
- Location and sampling source
- Time and date of sampling
- Pertinent well data, e.g., depth to water

- Sampling method, e.g., Teflon bailer
- Preservation
- Volume, type, and number of containers
- Weather
- Field-measured parameters of pH, temperature, and specific conductance
- Sample storage
- Comments, e.g., appearance of sample.

All samples will be transported to this laboratory with appropriate chain-of-custody forms and seals.

15.2 Laboratory Data

All laboratories for this study will be required to submit data that are supported by sufficient backup information and QC test results. This requirement will enable reviewers to determine the quality of the data (see Tables F-5 and F-6). SE/E will be responsible for data validation and compilation and will follow U.S. EPA guidelines for review of the analytical data as described below.

15.3 Data Validation

All laboratories for this study will be required to submit data that are supported by sufficient backup information and QA results. This requirement will enable reviewers to determine conclusively the quality of the data (see Tables F-5 and F-6).

SE/E holds responsibility for data validation and compilation and will follow U.S. EPA guidelines for review of data as appropriate (U.S. EPA, 1988).

Table F-5
RECOMMENDED DOCUMENTATION FOR INDEPENDENT
QA REVIEW OF DATA ON ORGANIC SUBSTANCES

1. Analyses of the requested priority pollutant acids, bases, neutrals (including PCBs and pesticides), and chemically similar compounds should be reported as follows:
 - Sample concentrations reported in proper units (e.g., sediment in ug/kg dry weight) to the appropriate number of significant figures on laboratory data sheets
 - Lower limits of detection for undetected values reported for each compound on a sample-by-sample basis
 - Internal standard recoveries for analyses using method recovery standards reported on the data sheets as percent recoveries
 - Ancillary information, including the actual spike level of any recovery standards (wet-weight basis), ratio of wet weight to dry weight in the sediment sample, final volume of the extract, and injection volume.
2. Other documentation should include the following:
 - The reconstructed ion chromatogram for each sample (or for each sample fraction if the extract has been analyzed in distinct chemical fractions)
 - GC/ECD chromatograms for pesticide/PCB analyses, with identification of peaks used for quantitation and any confirmation chromatograms
 - Complete data for all method blanks, reported as absolute mass of each blank contaminant determined; samples associated with each blank should be indicated

Raw data quantitation reports, including tabulated results (identification, GC/MS scan number/retention time, area, and quantity) for compounds in each sample analyzed by GC/MS

Table F-5 (continued)
RECOMMENDED DOCUMENTATION FOR INDEPENDENT
QA REVIEW OF DATA ON ORGANIC SUBSTANCES

- A statement in the cover letter describing how standard calibration curves were generated and applied to the samples for quantitation (and access to laboratory records of standard calibration curves for possible inspection)
- A statement in the cover letter describing any significant problems in any aspect of sample analysis (e.g., instrumental malfunctions, software problems during quantification)
- A tabulation on laboratory data sheets of instrument mass detection limits.

Table F-6
RECOMMENDED DOCUMENTATION FOR INDEPENDENT
QA REVIEW OF DATA ON INORGANIC SUBSTANCES

To minimize the amount of backup information provided, only the "raw" instrument readings for the duplicate and spike analyses are requested. Additional backup information would only be required if a review of the QA sample data indicated the need. Data reports from the laboratory should include the following information:

- Sample concentrations reported in proper units to the appropriate number of significant figures
- Method blank data associated with each sample
- Quantity of sample digested and final dilution volume
- Instrument detection limit for each element (denoting method of detection)
- Method detection limit
- Summary of all deviations from the prescribed methods
- Background corrections used (e.g., Zeeman)
- Spiked sample results with associated calibration procedures and instrument readings
- Results from all reference materials analyzed with the samples
- All problems associated with the analyses.

15.4 Data Base Management

Computers used for data management will be PC desktop or portables (IBM compatible, DOS). The data storage and calculation software used will be Lotus Symphony or Microsoft Excel spreadsheets. The data base will be stored on standard 5.25-inch mini disks. The ground water data and well construction data will be electronically formatted to comply with the Region X ground water management program.

PART G

HEALTH AND SAFETY PLAN

APPROVAL PAGE

Prepared by: _____

Anita Lovely
SE/E Project Manager

Approved by: _____

Dale Berndt, CIH
SE/E Health and Safety Officer

Approved by: _____

Bill Haldeman
SE/E Site Safety Officer

Approved by: _____

Dennis Goldman
SE/E Project Director

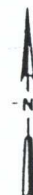
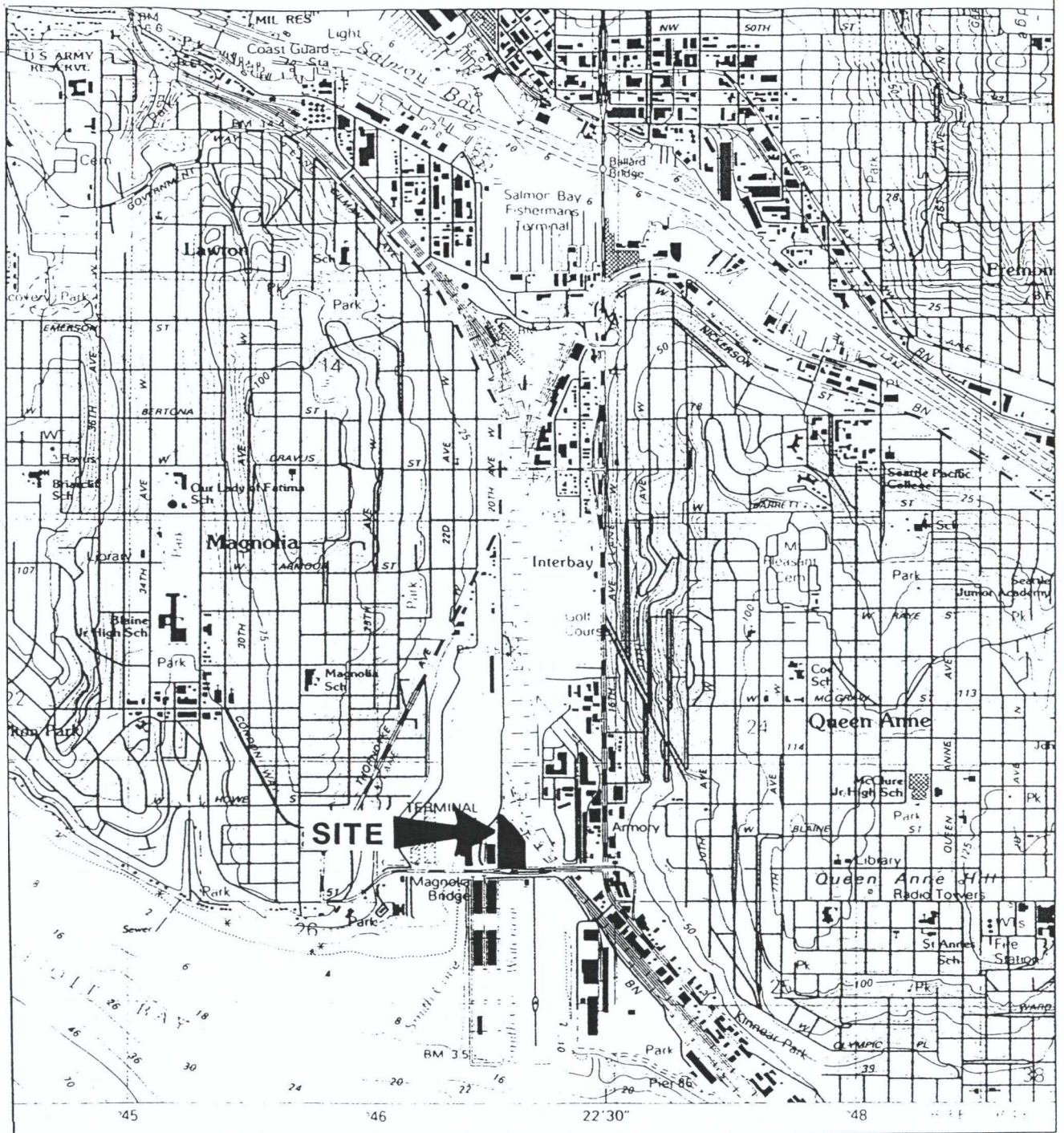
SITE SAFETY PLAN SUMMARY

Site:	Chempro Pier 91 Facility
Location:	2001 W. Garfield Seattle, Washington (see Figure G-1)
Proposed Dates of Investigation:	To be determined (based on schedule negotiated with EPA)
Duration of Investigation:	10-hour days, drilling on weekends
Type/Status of Site:	Active oil recycling facility
Size of Site:	Approximately 4 acres
Land Use of Area Surrounding Facility:	Industrial/warehouse/port activities
Factors Prompting Investigation:	Concentrations of benzene, toluene, ethylbenzene, xylene (BTEX), chlorinated organic compounds, and polyaromatic hydrocarbons (PAH) detected in soil and ground water
Contaminant Type:	BTEX, chlorinated organic compounds, PAHs
Chemical Hazards:	Inhalation and skin contact
Physical Hazards:	Cold stress, drilling, overhead hazards, and noise
Levels of Protection:	The minimum level of protection is modified Level D. Elevated concentrations of organics or PAH-contaminated dust may necessitate upgrading to Level C
Air Monitoring Equipment:	Photoionization detector
Factors Prompting Monitoring:	Documented concentrations of organic compounds in soil and ground water
Primary Emergency Contact:	Swedish Hospital 747 Summit Seattle, Washington
Site Access:	From SeaTac Airport: Take I-5 north to Denny Way. Take Denny Way to Elliott Avenue west. Proceed to Pier 91

1 PURPOSE

This Site Safety Plan establishes policies and procedures to protect Sweet-Edwards/EMCON, Inc (SE/E) personnel from the potential hazards posed by fieldwork at the Chempro Pier 91 site. The Site Safety Plan provides measures to minimize potential exposure, accidents, and physical injuries that may occur during daily on-site activities and during adverse conditions. It also provides contingencies for emergency situations.

This plan must be observed by all SE/E employees and subcontractors participating in the fieldwork. Medical surveillance, personal protection, respirator fit test, and hazardous waste operations training requirements according to OSHA 29 CFR 1910.120 shall be met by all personnel working in the control zone at this site. All observers present during these activities must also comply with all safety requirements of the plan. To help ensure safety compliance, all SE/E field participants and observers must read this plan and sign a certification stating that they agree to comply with all the plan conditions.



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Sweet-Edwards
EMCON

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REVIS.
PROJECT NO.
S9407.05

Figure G-1
CHEMPRO PIER 91 FACILITY
SITE LOCATION MAP

PART I
REFERENCES

US EPA Data Review Work Group.

- U.S. Environmental Protection Agency. 1988b. *Laboratory Data Validation Functional Guidelines for Evaluating Organic Analyses*. Prepared for the Hazardous Site Evaluation Division, US EPA by the US EPA Data Review Work Group.
- U.S. Environmental Protection Agency, November 1986. *Test Methods for Evaluating Solids Waste, SW-846*, Third Edition.
- U.S. Environmental Protection Agency Office of Solid Waste and Emergency Response, September 1988. *Technology Screening Guide for Treatment of CERCLA Soils and Sludges*.
- U.S. Environmental Protection Agency Office of Emergency and Remedial Response, December 1988. *Guidance on Remedial Actions for Contaminated Ground Water at Superfund Sites*.

2 KEY MANAGEMENT/HEALTH AND SAFETY PERSONNEL

Efficient on-site operations require that key personnel be identified and that their roles, responsibilities, and scope of authority be clearly defined.

Ms. Anita Lovely is the Project Manager for the Chempro Pier 91 RFI and will be responsible for project oversight. She will interact with Chempro personnel to ensure proper implementation of the Work Plan.

Mr. Bill Haldeman is the Project Geologist and Site Safety Officer and will be responsible for all site operations. He will have the primary responsibility for ensuring implementing personnel health and safety policy, correcting improper conditions, and following safety practices. Mr. Haldeman will be responsible for providing management support, enforcement, and allocation of necessary resources to assure implementation of the sampling plan. He will also be responsible for implementing this safety plan, will establish the control zone for each field effort, and will act to correct any safety deficiencies. He will notify the Health and Safety Officer prior to modifying any safety procedures detailed in this plan. As Site Safety Officer, he has authority to temporarily suspend site operations. Operations may resume only after appropriate actions have been developed through consultation among the Project Manager and the Health and Safety Officer.

Mr. Dale Berndt is SE/E's Health and Safety Officer. His responsibilities will be to review and approve the Site Safety Plan and any subsequent changes to the plan. In addition, he will provide technical support to the Site Safety Officer as needed. If warranted, he will conduct site safety audits to ensure that the Site Safety Plan is being implemented correctly.

Ms. Susan Donahue is the Chempro Project Manager. She will be responsible for coordination of facility activities with any SE/E activity. She will interact with the plant manager to ensure safe working conditions with minimal disruption to plant activities.

3 FIELD INVESTIGATION

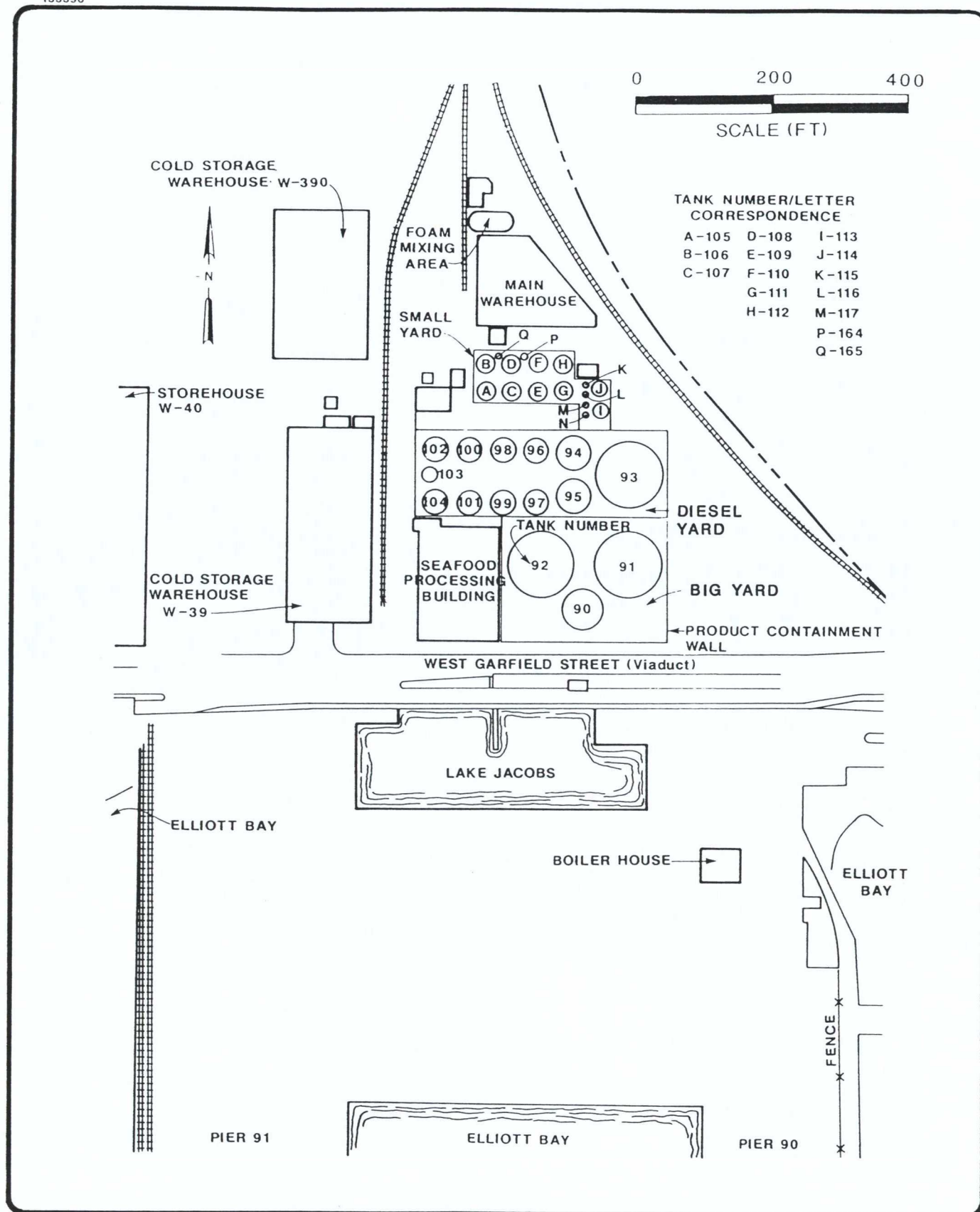
3.1 Scope of Work

The following field tasks will be accomplished during the field effort at the Chempro Pier 91 facility:

- Borehole drilling and soil sampling
- Installation of ground water monitoring wells
- Ground water quality sampling
- Aquifer pump tests

3.2 Site Control

The Site Safety Officer will establish decontamination zones and control zones within the study area to ensure that personnel are properly protected against hazards and that contamination is confined to appropriate areas. A map of the site showing existing and proposed sampling locations is shown on Figure G-2. The work zones may vary and may require modification depending on the field activities, field findings, and prevailing wind direction. All activities within the contaminated area shall be conducted with a partner (subcontractor or SE/E personnel).



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Figure G-2
CHEMPRO PIER 91 FACILITY
FACILITY MAP

3.3 Hazards

3.3.1 Chemical

The chemical hazards associated with this project area result from potential contact with benzene, toluene, ethylbenzene, xylene, chlorinated organic compounds, and polyaromatic hydrocarbons. These chemicals pose respiratory, ingestion, and dermal contact hazards and are known or suspected to be carcinogenic, mutagenic, or toxic.

Skin and eye contact and inhalation of organic vapors are the significant routes of exposure during sampling and well installation activities. Effects include central nervous system depression with symptoms such as dizziness, drowsiness, headache, fatigue, muscular weakness, and lack of coordination. Accidental ingestion may also occur through inadequate decontamination procedures or personal hygiene practices.

For PAH, skin contact will be the primary route of concern. PAH presents a respiratory or inhalation hazard only under windy or dusty conditions. PAH compounds include naphthalene, acenaphthylene, acenaphthene, fluorene, phenanthrene, fluoranthene, pyrene, benz(a)anthracene, chrysene, benzo(b)-fluoranthene, benzo(k)fluoranthene, benzo(a)pyrene, dibenzo(a,h)-anthracene, and indeno(1,2,3-cd)pyrene. Specific information on health hazard rating, symptoms of overexposure, and first aid is presented in Table G-1. Additional information describing physical and chemical properties of chemicals at the site are in Appendix G-1. Specific information on personal protective clothing is summarized in Tables G-2 and G-3.

3.3.2 Physical

Physical hazards associated with this fieldwork include disturbance of underground utilities during well drilling; eye and skin contact hazards during well drilling; cold stress; and possibly heat stress.

Drilling Hazards

Electrical cables, gas lines, water lines, and unknown objects may be located under proposed well sites on the Chempro Pier 91 facility. A physical survey by the utility companies will be conducted to identify utility

Table G-1
HEALTH EXPOSURE SUMMARY

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Benzene (human- carcinogen)	Low: due to expected concentrations at site.	Inhalation, ingestion, contact.	Inhalation/ingestion: dizziness, staggering, drowsiness, unconscious- ness, nausea, vomiting, and abdominal pain. Contact: skin, eye, nose, and throat irritation.	Eye contact: irrigate immediately. Skin contact: wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: seek medical attention. Do not induce vomiting.
Chromium	Very low: due to expected concentrations and pavement at the site.	Inhalation, ingestion, contact.	Inhalation: coughing, whee- zing, headache, dyspnea, pain on deep inspiration, fever, and loss of weight.	Eye contact: irrigate immediately. Skin contact: wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: induce vomiting by administering large volumes of water. Seek medical attention.
Cold Stress	Medium/High: due to environmental conditions during sampling.	Contact, Inhalation.	Hypothermia- shivering, numbness, lowered body temperature, drowsiness, and muscular weakness, sometimes resulting in death.	Remove cold, wet cloth- ing. Warm victim by wrapping in blankets or placing in tub of warm water. Administer hot, nonalcoholic liquids.

Table G-1
HEALTH EXPOSURE SUMMARY (continued)

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Heat stress	High: during elevated environmental temperatures.	Contact.	Heat rash; heat cramps; heat exhaustion (pale, clammy skin; profuse perspiration; weakness; headache; nausea); heat stroke (hot, dry skin; high fever; dizziness; nausea, rapid pulse; and unconsciousness).	Remove protective clothing; take temperature; cool off with a watery spray; have employee slowly drink 8 oz. of cool water, diluted, unsweetened fruit juice or Gatorade; have employee rest until oral temperature is less than 99°F. If body temperature > 100°F, seek medical attention.
Lead	Very low: due to expected concentrations and pavement at the site.	Inhalation, ingestion, contact.	Fatigue, sleep disturbance, headache, aching bones and muscles, abdominal pains, decreased appetite (flu-like symptoms).	Eye contact: irrigate immediately. Skin contact: wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration, as required. Ingestion: induce vomiting by administering large volumes of water. Seek medical attention.

Table G-1
HEALTH EXPOSURE SUMMARY (continued)

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Noise	Medium/High: when exposed to operations generating high sound pressure levels (e.g., drilling operation and portable generators). Contact limited by use of hearing protection.		Stress, tensing of muscles, headache, temporary or permanent hearing loss.	Remove from noise source.
Polynuclear aromatic hydrocarbons (PAHs)	Low/Medium: due to expected concentrations.	Inhalation: o particulates o vapors	Headache, dizziness. Requires medical surveillance. Cancer-causing agent.	Seek medical attention.
Chlorinated Solvents	Low: due to concentrations expected.	Inhalation, ingestion, contact.	Inhalation: loss of coordination, irritation to eyes, nose, throat. Ingestion: nausea, loss of coordination, throat irritation. Contact: skin dehydration and redness.	Inhalation: move to fresh air and apply artificial respiration if necessary. Ingestion: have victim drink water and induce vomiting. Eyes: flush thoroughly with water. Skin: remove contaminated clothing and wash exposed area with water and soap.

Table G-1
HEALTH EXPOSURE SUMMARY (continued)

HAZARD	HEALTH HAZARD RATING AT THIS SITE	ROUTE OF ENTRY	SYMPTOMS OF OVEREXPOSURE	FIRST AID
Xylene	Low: due to expected concentrations.	Inhalation, ingestion, contact.	Inhalation/ingestion: dizziness, staggering, drowsiness, unconsciousness, nausea, vomiting, and abdominal pain. Contact: skin, eye, nose, and throat irritation.	Eye contact: irrigate immediately. Skin contact wash with soap and water. Inhalation: move immediately to fresh air. Perform artificial respiration as required. Ingestion: seek medical attention. Do not induce vomiting.

(a) mg/m^3 - milligrams per cubic meter

^a TWA - Time-weighted average

Table G-2
REQUIRED PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

LEVEL D

Protective Clothing

- Uncoated-Tyvek or Kleenguard coveralls
- Neoprene outer gloves
- Vinyl inner gloves
- Steel toe, steel shank neoprene boots
- Safety glasses/goggles
- Hard hat

Safety Equipment

- Photoionization detector
- Decontamination equipment
- Pressurized eyewash
- First aid kit

MODIFIED LEVEL D

Protective Clothing

- Polyethylene-coated Tyvek coveralls
- Neoprene outer gloves
- Vinyl inner gloves
- Steel toe, steel shank neoprene boots
- Safety glasses/goggles
- Hard hat

Safety Equipment

- Photoionization detector
- Decontamination equipment
- Pressurized eyewash
- First aid kit

Table G-2 (continued)
REQUIRED PROTECTIVE CLOTHING AND SAFETY EQUIPMENT

LEVEL C

Protective Clothing

- Full-face, air-purifying respirator with combination organic vapor/HEPA dust cartridges
- Polyethylene-coated Tyvek coveralls
- Neoprene outer gloves
- Vinyl inner gloves
- Steel toe, steel shank neoprene boots
- Hard hat

Safety Equipment

- Photoionization detector
- Decontamination equipment
- Pressurized eyewash
- First aid kit

LEVEL B

Protective Clothing

- Self-Contained Breathing Apparatus (SCBA)
- Saran-coated (SARANEX) Tyvek coveralls
- Neoprene outer gloves
- Vinyl inner gloves
- Steel toe, steel shank neoprene boots
- Hard hat

Safety Equipment

- Photoionization detector
- Decontamination equipment
- Pressurized eyewash
- First aid kit

Table G-3
DECISION CRITERIA FOR UPGRADING OF
PERSONAL PROTECTIVE CLOTHING

AGENT(S)	MONITORING INSTRUMENT	DECISION LEVEL	REQUIRED PROTECTION
Organics (volatile)	PID	Background	Modified Level D
Organics (volatile)	PID	1 unit above background	Level C
Organics (volatile)	PID	5 units above background	Level B or leave area

lines and pipes and to detect buried objects. SE/E personnel will monitor for organic vapors during installation of wells by the contract drilling firm. Eye and skin contact from contaminated water and rocks or other projectiles is also of concern during drilling. Safety glasses will be required for protection from potential eye injury.

Cold Stress

During the proposed dates of fieldwork, the Chempro Pier 91 facility may be subject to low temperatures, rain, and winds. Care must be taken to limit cold exposure by providing proper protective clothing, access to warm shelter, and a temperature-dependent work regimen limiting periods of outdoor activity.

Cold stress can be manifested as hypothermia. Hypothermia is a cold-induced decrease in the core body temperature that produces shivering, numbness, drowsiness, muscular weakness, and if severe enough, death. All personnel should be familiar with the symptoms of cold stress and appropriate first aid measures.

Heat Stress

When SE/E personnel encounter temperatures above 70° F, SE/E should be aware of heat stress precautions. Personnel who must wear protective clothing while working in warm temperatures are subject to heat-induced physiological stress since little evaporative cooling can occur. Heat stress can result in minor symptoms such as heat rash and heat cramps or severe effects such as heat exhaustion and heat stroke. Heat rash is a skin irritation resulting from prolonged contact with wet clothing. It can be prevented by allowing the skin to dry completely during rest periods and by showering at the end of the work day. Heat cramps, heat exhaustion, and heat stroke all result from the excessive loss of body fluids and electrolytes. The symptoms of heat cramps are spasms in the abdomen or limbs. Heat exhaustion results from more severe dehydration. Symptoms include pale, clammy skin; profuse perspiration; weakness; headache; and nausea. Heat stroke is a life-threatening condition that occurs when the body's temperature-regulating system no longer functions properly. Symptoms include hot, dry skin; a high fever (often 106°F or more); dizziness, nausea; rapid pulse; and unconsciousness. Brain damage and death may follow if the body temperature is not reduced. All personnel should be familiar with the symptoms of heat stress and appropriate first aid and precautionary measures. The proper work regimen, adequate fluid intake, and electrolyte replacement are vital in the prevention of heat stress.

In temperatures of 70° F and above, the following provides guidance for a work/rest regimen for personnel wearing Level C protection:

- 70° to 85°F - workers should not be allowed to work more than 1 hour without at least a 15-minute break
- 85° to 95° F - workers should not be allowed to work more than 45 minutes without at least a 15-minute break
- Exceeding 95° F - workers should not be allowed to work more than 15 minute without a 15 minute break.

If extreme temperature conditions are encountered, consideration should be given to rescheduling work for the cooler morning or evening hours.

3.4 Levels of Protection and Safety Equipment

Protective clothing is necessary to prevent contact with potentially hazardous concentrations of chemical agents. The minimum protective clothing requirements by activity or location are as follows:

- Site reconnaissance - Level D
- Sampling handling - Modified Level D
- Drilling oversight - Modified Level D or Level C

Additional protective clothing and safety equipment requirements are summarized in Table G-2. If contaminants present a health risk as defined in Table G-3, personal protective clothing may need to be upgraded.

3.5 Field Monitoring Requirements

3.5.1 Initial Monitoring

Field monitoring shall be conducted upon initial site entry to meet the following objectives:

- Determine existing or potential hazards that may affect personnel performing the work tasks.

- Verify existing information and gather additional site-specific environmental data.
- Collect supplemental information to determine the safety requirements for personnel entering the site.

Monitoring instrumentation for the task shall include the following items:

- Photoionization detector

Specific operating and calibration requirements are summarized in Appendix G-2. The main focus of the initial monitoring is to rapidly identify immediate hazards and determine background concentrations. Upon initial site entry, the team will survey the site and monitor for organic vapors. Dust monitoring will not be conducted because the site is paved and the potential for dusty conditions is very low. If the contaminant levels exceed the decision levels identified in Table G-3, personal protection upgrading will be required before fieldwork can commence. All initial and periodic monitoring results shall be documented in the field logbook.

3.5.2 Follow-up Monitoring

Monitoring shall also be conducted periodically throughout sampling activities for organic vapors to ensure that the survey personnel are properly protected. Periodic monitoring will not be required if it is raining. Air quality measurements will be taken approximately every 10 feet when drilling. Air space around the open boreholes will be monitored and the field geologist will determine if additional monitoring is necessary or a higher level of personal safety is needed. The decision for additional monitoring will be based upon field conditions such as change in organic concentrations from a borehole, breakthrough in cartridge respirators, complaints of initial acute exposure symptoms from field personnel, or any other indications of a potential hazard.

Specific monitoring instruments and decision levels are summarized in Table G-3.

3.5.3 Personnel Air Monitoring

Personnel air monitoring may be conducted to assess the airborne concentration of identified contaminants and determine appropriate health and safety requirements. The decision to conduct personnel air monitoring will

be made by the Site Safety Officer and will be based on area monitoring results, site characterization findings, or the need for additional information.

3.6 Decontamination

3.6.1 Personnel

Prior to commencing fieldwork, the Site Safety Officer will establish the decontamination layout and procedures for the site. All personnel leaving zones designated by the Site Safety Officer as potentially contaminated must follow the decontamination procedures established by the Site Safety Officer. Most of the protective clothing for modified Level D and Level C protection is disposable and should be removed, bagged, and properly disposed of. If nondisposable clothing is used, it must be decontaminated with detergent and water before reuse. If respirators are worn, they must be disinfected daily using the manufacturer-supplied disinfectant solution. All personnel should shower as soon as possible after leaving the site. Specific procedures for modified Level D and Level C are shown in Table G-4.

Equipment for decontamination measures will include 20- to 30-gallon wash basins, plastic liners, plastic drop cloths, Alconox, rinse water, scrub brushes, towels, benches or stools, tape, and face masks and cartridges.

3.6.2 Equipment

The sampling equipment will be decontaminated with a steam cleaner and Alconox and water between sampling stations. If methanol washes are performed, Level C protection must be worn. The Site Safety Officer will select respirator cartridges and protective clothing compatible with the decontaminating solution.

Table G-4
DECONTAMINATION PROCEDURES

Modified Level D and Level C Decontamination:

Segregated equipment drop	Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboard, etc.) on plastic drop cloths or in different containers with plastic liners. Segregation at the drop site reduces the probability of cross-contamination. During hot weather operations, a cool-down station may be set up within this area.
Tape removal	Remove tape around boots and gloves and deposit in container with plastic liner. ^b
Outer glove removal	Remove outer gloves and deposit in container with plastic liner.
Boot wash	Wash safety boots with long-handled scrub brush andalconox detergent. Rinse off decontamination solution with water. Repeat as many times as necessary.
Canister or mask change ^a	If worker leaves exclusion zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and joints taped, and worker returns to duty.
Safety boot removal	Remove safety boots and deposit in container with plastic liner.
Facepiece removal ^a	Remove facepiece. Deposit in container with plastic liner. Avoid touching face with fingers.
Inner glove removal	Remove inner gloves and deposit in lined container.

Table G-4 (continued)
DECONTAMINATION PROCEDURES

Inner clothing removal	Remove clothing soaked with perspiration and place in lined container. If inner clothing is contaminated, do not wear off-site. If inner clothing is not contaminated, inner clothing may be worn off-site.
Field wash	Shower if highly toxic, skin-corrosive, or skin-absorbable materials are known or suspected to be present. Wash hands and face if shower is not available.
Re-dress	Put on clean clothes.

^a Additional requirements for Level C decontamination.

^b Chempro will be responsible for disposition of all waste material including disposable clothing.

4 TRAINING AND MEDICAL MONITORING REQUIREMENTS

4.1 Training Requirements

All SE/E employees will be trained to recognize and avoid the potential hazards at the job site. All field personnel and the Project Manager have received 40 hours of training covering the following:

- Site Safety Plans
- Safe work practices
- Nature of anticipated hazards
- Handling emergencies and self-rescue
- Rules and regulations for vehicle use
- Safe use of field equipment
- Handling, storage, and transportation of hazardous materials
- Employee rights and responsibilities, use, care, and limitations of personal protective clothing and equipment
- Safe sampling techniques

In addition, all SE/E employees will be properly trained in the use of an air-purifying respirator and in its capabilities, limitations, and maintenance. As required under Occupational Safety and Health Administration standards, all personnel must be qualitatively fit-tested prior to wearing a respirator. The SE/E Site Safety Officer will be trained in the proper selection of respiratory protection, protective clothing, fit-testing procedures, air monitoring instruments and techniques, confined space entry, hazard recognition and evaluation, and exposure symptoms for the contaminants of concern.

4.2 Medical Monitoring Requirements

In accordance with the SE/E Corporate Health and Safety Program, all employees who may be exposed to hazardous materials in the course of their work are required to participate in the Corporate Medical Monitoring Program. Prior to working at the Chempro Pier 91 facility, all employees must receive a baseline medical examination, including analysis of blood and urine for heavy metals. All employees must also be certified as fit for working with a respirator. If an employee suspects exposure, additional medical monitoring will be available and the employee must submit an Exposure/Injury Incident Report. All employees participating in this project will be required to undergo annual follow-up medical examinations.

5 EMERGENCY PLANNING

It will be the responsibility of the Sweet-Edwards/EMCON Site Safety Officer to determine the appropriate response to an emergency incident. The response sequence will be to 1) remove all personnel from the area, 2) assess the severity of the incident, 3) contact appropriate emergency assistance, and 4) swiftly move to a rendezvous point for aid.

The following planning measures will be instituted to facilitate responses to emergency situations:

1. The Site Safety Officer will conduct a safety briefing prior to the start of work. Copies of this Site Safety Plan will be distributed to all project personnel. After reading the plan, all personnel will be required to sign a Site Safety Plan consent agreement. The consent agreement form is attached as Appendix G-3.
2. All SE/E personnel will review the Chempro Pier 91 facility safety procedures.
3. All SE/E personnel will be instructed in the use of all field safety equipment before any field sampling takes place.
4. The Project Manager will verify that all field staff have fulfilled the project training and medical monitoring requirements.
5. The Site Safety Officer will notify the Plant Manager of the field activities and potential chemical exposures prior to commencement of the field effort.
6. The Site Safety Officer will check to see that all required safety equipment is at the job site prior to the start of each day's field activities.

5.1 Emergency Communications Protocol

The following visual signals will be used as emergency communication signals:

- Hand clutching throat: out of air/can't breathe
- Hands on top of head: needs assistance
- Thumbs up: OK/I'm alright/I understand
- Thumbs down: no/negative
- Grip partner's wrist or both hands around partner's waist: leave area immediately

5.2 Injury or Exposure

Employees are required to notify the Site Safety Officer of any suspected exposure. In the event of any injury or suspected exposure, the Site Safety Officer will contact the appropriate hospital and ambulance service if necessary, through the 911 emergency number. The emergency route from the Chempro Pier 91 site is described in Section 6.

As soon as possible after an injury or suspected exposure, the Site Safety Officer must investigate the circumstances surrounding the injury or exposure and submit a SE/E Exposure/Injury Incident Report to the Health and Safety Officer. This report will include recommendations on how to prevent occurrence of similar events.

6 EMERGENCY CONTACTS

LOCAL/SITE RESOURCES

Hospitals

Swedish Hospital (206) 386-2973
747 Summit
Seattle, Washington

Directions to Hospital

Take Elliott Way. Proceed south to Denny Way. Take I-5 south to James Street exit. Take James to Broadway. Proceed to Madison. Hospital is at intersection of Broadway and Madison.

Emergency Medical Information

Poison Information Center, 4800 Sand Pt. Way NE, Seattle
City of Seattle Emergency Services

Emergency Transportation Systems (Fire, Police, Ambulance)

Police Department	911
Fire Department	911
Ambulance Service	911

Corporate Resources

Project Manager	Work (206) 485-5000	Project Geologist	Work (206) 485-5000
Anita Lovely	Home (206) 784-0675	Bill Haldeman	Home (206) 363-2384
Health and Safety Officer	Work (206) 485-5000	Site Safety Officer	Work (206) 485-5000
Dale Berndt, CIH	Home (206) 573-8992	Bill Haldeman	Home (206) 363-2384

Other Resources

Chempro Project Manager (Susan Donahue)	(206) 223-0500
Superfund/RCRA Hotline	(800) 424-9346
Chemtrec	(800) 424-9300

Appendix G-1

HAZARDOUS MATERIALS INFORMATION

CHLOROBENZENE

- Hazardous substance (EPA)
- Hazardous waste (EPA)
- Priority toxic pollutant (EPA)

Description: C_6H_5Cl , a colorless liquid boiling at 131° to $132^\circ C$ with a mild aromatic odor.

Code Numbers: CAS 108-90-7 RTECS CZ0175000 UN 1134

DOT Designation: Flammable liquid.

Synonyms: Monochlorobenzene, chlorobenzol, phenyl chloride, MCB.

Potential Exposure: Chlorobenzene is used in the manufacture of aniline, phenol, and chloronitrobenzene and as an intermediate in the manufacture of dyestuffs and many pesticides (A-32).

Incompatibilities: Strong oxidizers.

Permissible Exposure Limits in Air: The Federal limit and the 1983/84 ACGIH TWA value is 75 ppm (350 mg/m^3). There is no STEL value set. The IDLH level is 2,400 ppm.

Determination in Air: Charcoal adsorption followed by workup with CS_2 and analysis by gas chromatography. See NIOSH Methods, Set 1. See also reference (A-10).

Permissible Concentration in Water: To protect freshwater aquatic life: 250 $\mu\text{g/l}$ on an acute basis for chlorobenzenes as a class. To protect saltwater aquatic life: 160 $\mu\text{g/l}$ on an acute basis and 129 $\mu\text{g/l}$ on a chronic basis for chlorinated benzenes as a class. To protect human health: for the prevention of adverse toxicological effects, 488 $\mu\text{g/l}$; but to prevent adverse organoleptic effects, 20 $\mu\text{g/l}$.

Determination in Water: Gas chromatography (EPA Methods 601 and 602) or gas chromatography plus mass spectrometry (EPA Method 624).

Routes of Entry: Inhalation, ingestion, eye and skin contact.

Harmful Effects and Symptoms: Irritation of the eyes and nose; drowsiness, incoherence; skin irritation; liver damage.

Points of Attack: Respiratory system, eyes, skin, central nervous system, liver.

Medical Surveillance: Consider the points of attack in preplacement and periodic physical examinations.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, wash with soap promptly. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Do NOT induce vomiting.

Personal Protective Methods: Wear appropriate clothing to prevent repeated or prolonged skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is wet or contaminated. Remove clothing immediately if wet or contaminated to avoid flammability hazard.

Respirator Selection:

- 1,000 ppm: CCROVF
- 2,400 ppm: GMOV/SAF/SCBAF
- Escape: GMOV/SCBA

Disposal Method Suggested: Incineration, preferably after mixing with another combustible fuel; care must be exercised to assure complete combustion to prevent the formation of phosgene; an acid scrubber is necessary to remove the halo acids produced.

References

- (1) U.S. Environmental Protection Agency, *Chlorinated Benzenes: Ambient Water Quality Criteria*, Washington, DC (1980).
- (2) U.S. Environmental Protection Agency, *Chlorobenzene*, Health and Environmental Effects Profile No. 42, Office of Solid Waste, Washington, DC (April 30, 1980).
- (3) See Reference (A-61).
- (4) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 2, No. 4, 72-75, New York, Van Nostrand Reinhold Co. (1982).

POLYCHLORINATED BIPHENYLS (PCBs)

- Carcinogens (Animal positive, IARC) (4)
- Hazardous materials (EPA)
- Hazardous waste constituents (EPA)
- Priority toxic pollutants (EPA)

Description: $C_{12}H_{10-x}Cl_x$, diphenyl rings in which one or more hydrogen atoms are replaced by a chlorine atom. Most widely used are chlorodiphenyl (42% chlorine), containing 3 chlorine atoms in unassigned positions, and chlorodiphenyl (54% chlorine) containing 5 chlorine atoms in unassigned positions. These compounds are light, straw-colored liquids with typical chlorinated aromatic odors; 42% chlorodiphenyl is a mobile liquid and 54% chlorodiphenyl is a viscous liquid.

Polychlorinated biphenyls are prepared by the chlorination of biphenyl and hence are complex mixtures containing isomers of chlorobiphenyls with different chlorine contents. It should be noted that there are 209 possible compounds obtainable by substituting chlorine for hydrogen on from one to ten different positions on the biphenyl ring system. An estimated 40 to 70 different chlorinated biphenyl compounds can be present in each of the higher chlorinated commercial mixtures. For example, Arochlor 1254 contains 69 different molecules, which differ in the number and position of chlorine atoms.

It should also be noted that certain PCB commercial mixtures produced in the United States and elsewhere (e.g., France, Germany, and Japan) have been shown to contain other classes of chlorinated derivatives, e.g., chlorinated naphthalenes and chlorinated dibenzofurans. The possibility that naphthalene and dibenzofuran contaminate the technical biphenyl feedstock used in the preparation of the commercial PCB mixtures cannot be excluded.

Code Numbers: CAS 1336-36-3 RTECS TQ1350000 UN 2315

DOT Designation: ORM-E.

Synonyms: PCBs, chlorodiphenyls, Aroclors®, Kanechlors®.

Potential Exposures: Chlorinated diphenyls are used alone and in combination with chlorinated naphthalenes. They are stable, thermoplastic, and non-flammable, and find chief use in insulation for electric cables and wires in the production of electric condensers, as additives for extreme pressure lubricants, and as a coating in foundry use.

Polychlorinated biphenyls (PCBs, first introduced into commercial use more than 45 years ago) are one member of a class of chlorinated aromatic organic compounds which are of increasing concern because of their apparent ubiquitous dispersal, persistence in the environment, and tendency to accumulate in food chains, with possible adverse effects on animals at the top of food webs, including man.

Incompatibilities: Strong oxidizers.

Permissible Exposure Limits in Air: The Federal standards and 1983/84 ACGIH TWA values for chlorodiphenyl (42% Cl) and chlorodiphenyl (54% Cl) are 1 mg/m³ and 0.5 mg/m³, respectively. NIOSH has recommended a level of 1.0 µg/m³ on a 10-hour TWA basis for both compounds. The STEL values adopted by ACGIH are 2 mg/m³ and 1.0 mg/m³, respectively. The IDLH levels are 10 mg/m³ and 5 mg/m³, respectively.

Determination in Air: For the 42% Cl compound, use of a filter plus bubbler

followed by gas chromatography. See NIOSH Methods, Set 2. For the 54% Cl compound, use of a filter, workup with petroleum ether, analysis by gas chromatography. See NIOSH Methods, Set 1. See also reference (A-10).

Permissible Concentration in Water: To protect freshwater aquatic life—0.014 µg/l as a 24-hour average. To protect saltwater aquatic life—0.030 µg/l as a 24-hour average. To protect human health—preferably zero. An additional lifetime cancer risk of 1 in 100,000 results at a level of 0.00079 µg/l.

Determination in Water: Gas chromatography (EPA Method 608) or gas chromatography plus mass spectrometry (EPA Method 625).

Routes of Entry: Inhalation of fume or vapor and percutaneous absorption of liquid, ingestion, eye and skin contact.

Harmful Effects and Symptoms: *Local* — Prolonged skin contact may cause the formation of comedones, sebaceous cysts, and pustules, known as chloracne. Irritation of eyes, nose, and throat may also occur. The above standards are considered low enough to prevent systemic effects, but it is not known whether or not these levels will prevent local effects.

Systemic — Generally, toxic effects are dependent upon the degree of chlorination; the higher the degree of substitution, the stronger the effects. Acute and chronic exposure can cause liver damage. Signs and symptoms include edema, jaundice, vomiting, anorexia, nausea, abdominal pains, and fatigue.

Studies of accidental oral intake indicate that chlorinated diphenyls are embryotoxic, causing stillbirth, a characteristic grey-brown skin, and increased eye discharge in infants born to women exposed during pregnancy.

Certain polychlorinated biphenyls are carcinogenic in mice and rats after oral administration, producing liver tumors (4).

A slight increase in the incidence of cancer, particularly melanoma of the skin, has been reported in a small group of men exposed occupationally to Arochlor 1254, a mixture of polychlorinated biphenyls (4,7).

Points of Attack: Skin, eyes, liver.

Medical Surveillance: Placement and periodic examinations should include an evaluation of the skin, lung, and liver function. Possible effects on the fetus should be considered.

First Aid: If this chemical gets into the eyes, irrigate immediately. If this chemical contacts the skin, wash with soap immediately. If a person breathes in large amounts of this chemical, move the exposed person to fresh air at once and perform artificial respiration. When this chemical has been swallowed, get medical attention. Give large quantities of saltwater and induce vomiting. Do not make an unconscious person vomit.

Personal Protective Methods: Wear appropriate clothing to prevent any possibility of skin contact. Wear eye protection to prevent any reasonable probability of eye contact. Employees should wash promptly when skin is wet or contaminated. Remove nonimpervious clothing promptly if wet or contaminated.

Respirator Selection:

42% Cl compound, 10 mg/m³: SAF/SCBAF
Escape: GMPEst/SCBA

54% Cl compound, 5 mg/m³: SAF/SCBAF
Escape: GMPEst/SCBA

Disposal Method Suggested: Incineration (3000°F) with scrubbing to remove any chlorine-containing products (A-31). In addition, some chemical waste

POLYNUCLEAR AROMATIC HYDROCARBONS

- Carcinogen (Benzo[a]pyrene) (Animal positive, IARC) (8)
- Hazardous wastes (EPA)
- Priority toxic pollutants (EPA)

Description: The polynuclear aromatic hydrocarbons constitute a class of materials of which benzo[a]pyrene is one of the most common and also the most hazardous.

Benzo[a]pyrene, $C_{20}H_{12}$, is a yellowish crystalline solid, melting at 179°C . It consists of five benzene rings joined together. Other polynuclear aromatics which are discussed in separate sections in this volume are as follows: acenaphthene, fluoranthene and naphthalene. A variety of abbreviations are in common use for the polynuclear aromatics as shown below:

Abbreviation	Compound Designated
A	Anthracene
BaA	Benzo[a]anthracene (1,2-benzanthracene)
BaP (also BP)	Benzo[a]pyrene (3,4-benzopyrene)
BbFL (also BbF)	Benzo[b]fluoranthene
BeP	Benzo[e]pyrene
BjFL (also BjF)	Benzo[j]fluoranthene
BkFL (also BkF)	Benzo[k]fluoranthene (11,12-benzofluoranthene)
BPR	Benzo[ghi]perylene (1,12-benzoperylene)
CH (also CR)	Chrysene
DBA	Dibenzo[ah]anthracene (1,2,5,6-benzanthracene)
DBAc	Dibenz[a,h] and [a,j] acridine
DBC	Dibenzocarbazole

(continued)

Abbreviation	Compound Designated
DBP	Dibenzopyrene
F	Fluorene
FL (also F)	Fluoranthene
IP	Indeno[1,2,3-cd]pyrene
P	Pyrene
PA (also Phen)	Phenanthrene
PR (also Per)	Perylene

Note: These abbreviations are not endorsed by any body such as the International Union of Chemistry; rather they are a form of shorthand used by authors for convenience, and they vary with the author.

Code Numbers: (For benzo[a]pyrene) CAS 50-32-8 RTECS DJ3675000

DOT Designation: —

Synonyms: PNAs, PAHs, PPAHs (Particulate Polycyclic Aromatic Hydrocarbons) and POMs (Polynuclear Organic Materials). (Benzo[a]pyrene is also known as BAP.)

Potential Exposures: PNAs can be formed in any hydrocarbon combustion process and may be released from oil spills. The less efficient the combustion process, the higher the PNA emission factor is likely to be. The major sources are stationary sources, such as heat and power generation, refuse burning, industrial activity, such as coke ovens, and coal refuse heaps. While PNAs can be formed naturally (lightning-ignited forest fires), impact of these sources appears to be minimal. It should be noted, however, that while transportation sources account for only about 1% of emitted PNAs on a national inventory basis, transportation-generated PNAs may approach 50% of the urban resident exposures.

Because of the large number of sources, most people are exposed to very low levels of PNAs. BAP has been detected in a variety of foods throughout the world. A possible source is mineral oils and petroleum waxes used in food containers and as release agents for food containers. FDA studies have indicated no health hazard from these sources.

The air pollution aspects of the carcinogenic polynuclear aromatic hydrocarbons (PAH) and of benzo[a]pyrene (BAP) in particular have been reviewed in some detail by Olsen and Haynes (1). The total emissions of benzo[a]pyrene (BAP) and some emission factors for BAP are as presented by Goldberg (2).

Permissible Exposure Limits in Air: A TLV of 0.2 mg/m^3 as benzene solubles has been assigned by ACGIH. These materials are designated by ACGIH as human carcinogens.

There have been few attempts to develop exposure standards for PAHs, either individually or as a class. In the occupational setting, a Federal standard has been promulgated for coke oven emissions, based primarily on the presumed effects of the carcinogenic PAH contained in the mixture as measured by the benzene soluble fraction of total particulate matter. Similarly, the American Conference of Governmental Industrial Hygienists recommends a workplace exposure limit for coal tar pitch volatiles, based on the benzene-soluble fraction containing carcinogenic PAH.

The National Institute for Occupational Safety and Health has also recommended a workplace standard for coal tar products (coal tar, creosote, and coal tar pitch), based on measurements of the cyclohexane-extractable fraction. These standards are summarized on the following page.

Substance	Exposure Limit	Agency
Coke oven emissions	150 $\mu\text{g}/\text{m}^3$, 8 hr time-weighted average	U.S. Occupational Safety and Health Administration
Coal tar products	0.1 mg/m^3 , 10 hr time-weighted average	U.S. National Institute for Occupational Safety and Health
Coal tar pitch and volatiles	0.2 mg/m^3 (benzene soluble fraction) 8 hr time-weighted average	American Conference of Governmental Industrial Hygienists

Determination in Air: Collection on a membrane filter, benzene extraction, chromatographic separation, measurement by fluorometry or using a UV detector (A-10).

Permissible Concentration in Water: A drinking water standard for PAH as a class has been developed. The 1970 World Health Organization European Standards for Drinking Water recommends a concentration of PAH not to exceed 0.2 $\mu\text{g}/\text{L}$. This recommended standard is based on the composite analysis of six PAHs in drinking water: fluoranthene, benzo[a]pyrene, benzo[ghi]perylene, benzo[b]fluoranthene, benzo[k]fluoranthene, and indeno[1,2,3-cd]pyrene.

The US EPA addressed PAHs as one of the 65 priority toxic pollutants (3). They found that there was insufficient data to propose a criterion for the protection of freshwater or of saltwater aquatic life. For the protection of human health, the concentration is preferably zero. An additional lifetime cancer risk of 1 in 100,000 is posed by a concentration of 0.028 $\mu\text{g}/\text{L}$.

Determination in Water: Methylene chloride extraction followed by high performance liquid chromatography (HPLC) with fluorescence or UV detection or gas chromatography (EPA Method 610), or by gas chromatography plus mass spectrometry (EPA Method 625).

Routes of Entry: Inhalation of particulates, vapors.

Harmful Effects and Symptoms: Certain PNAs which have been demonstrated as carcinogenic in test animals at relatively high exposure levels are being found in urban air at very low levels. Various environmental fate tests suggest that PNAs are photo-oxidized, and react with oxidants and oxides of sulfur. Because PNAs are adsorbed on particulate matter, chemical half-lives may vary greatly, from a matter of a few hours to several days. One researcher reports that photo-oxidized PNA fractions of air extracts also appear to be carcinogenic. Environmental behavior/fate data have not been developed for the class as a whole.

It has been observed that PNAs are highly soluble in adipose tissue and lipids. Most of the PNAs taken in by mammals are oxidized and the metabolites excreted. Effects of that portion remaining in the body at low levels have not been documented.

Benzo[a]pyrene (BaP), one of the most commonly found and hazardous of the PNAs has been the subject of a variety of toxicological tests, which have been summarized by the International Agency for Research on Cancer. 50 to 100 ppm administered in the diet for 122 to 197 days produced stomach tumors in 70% of the mice studied. 250 ppm produced tumors in the forestomach of 100% of the mice after 30 days. A single oral administration of 100 mg of nine rats produced mammary tumors in eight of them. Skin cancers have been induced in a variety of animals at very low levels, and using a variety of solvents (length of application was not specified).

Lung cancer developed in 2 of 21 rats exposed to 10 mg/m^3 BaP and 3.5 ppm SO_2 for 1 hour per day, five days a week, for more than one year. Five of 21 rats receiving 10 ppm SO_2 for 6 hours per day, in addition to the foregoing dosage, developed similar carcinomas. No carcinomas were noted in rats receiving only SO_2 . No animals were exposed only to BaP. Transplacental migration of BaP has been demonstrated in mice. Most other PNAs have not been subjected to such testing.

Medical Surveillance: Preplacement and regular physical examination are indicated for workers having contact with polynuclear aromatics in the workplace.

Personal Protective Methods: Good particulate emission controls are the indicated engineering control scheme where polynuclear aromatics are encountered in the workplace.

Disposal Method Suggested: Incineration.

References

- (1) Olsen, D.A. and Haynes, J.L., *Air Pollution Aspects of Organic Carcinogens*, Report PB-188 090, Springfield, VA, Nat. Tech. Information Service (September 1969).
- (2) Goldberg, A.J., *A Survey of Emissions and Controls for Hazardous and Other Pollutants*, Report PB-223 568, Springfield, VA, Nat. Tech. Information Service (Feb. 1973).
- (3) U.S. Environmental Protection Agency, *Polynuclear Aromatic Hydrocarbons: Ambient Water Quality Criteria*, Washington, DC (1980).
- (4) U.S. Environmental Protection Agency, *Status Assessment of Toxic Organic Chemicals: Polynuclear Aromatic Hydrocarbons*, Report EPA-600/2-79-210L, Cincinnati, OH (December 1979).
- (5) National Academy of Sciences, *Medical and Biologic Effects of Environmental Pollutants: Particulate Polycyclic Organic Matter*, Washington, DC (1972).
- (6) U.S. Environmental Protection Agency, *Health Assessment Document for Polycyclic Organic Matter*, Research Triangle Park, NC, Environmental Criteria and Assessment Office (1979).
- (7) U.S. Environmental Protection Agency, *Polynuclear Aromatic Hydrocarbons*, Health and Environmental Effects Profile No. 149, Office of Solid Waste, Washington, DC (April 30, 1980).
- (8) International Agency for Research on Cancer, *IARC Monographs on the Carcinogenic Risks of Chemicals to Humans*, Lyon, France, 3, 91 (1973).
- (9) See Reference (A-62) for: Benz[a]anthracene, Benzo[b]fluoranthene and Benzo[j]fluoranthene, Dibenz[a,h]acridine and Dibenz[j]acridine, Dibenz[a,h]anthracene, Dibenz[c,g]carbazole, Dibenz[a,h]pyrene, Dibenz[a,i]pyrene, and Indeno[1,2,3-cd]pyrene.
- (10) Sax, N.I., Ed., *Dangerous Properties of Industrial Materials Report*, 4, No. 2, 35-37, New York, Van Nostrand Reinhold Co. (1984) (Acenaphthylene).
- (11) Parmeggiani, L., Ed., *Encyclopedia of Occupational Health & Safety*, Third Edition, Vol. 2, pp 1755-59, Geneva, International Labour Office (1983).

Appendix G-2

INSTRUMENT INSTRUCTIONS¹

¹ The instrument instructions in this appendix are simplified, one-page reminder instruction sheets for field use. These instruction sheets are not a replacement for the instruction manual and pre-field training.

TIP II PHOTOIONIZATION DETECTOR

This instrument is intended to detect compounds with ionization potentials of less than 10.6 eV.

1. Upon pressing the POWER switch, you will see numerals on the liquid crystal display (LCD), the pump will run for half a second, and the two yellow light-emitting diodes (LEDs) in the display compartment will flash on for half a second. Within 2 minutes, the pump and LEDs will come on continuously indicating that the ultraviolet lamp of TIP II has started.
2. The locking ring on the ZERO and SPAN controls are designed to operate by pressing against the underside of the control knobs. Turn the locking rings clockwise to release the knobs.
3. A setting of 5 on the SPAN control gives TIP II a mid-range sensitivity. The highest sensitivity is at a span of 9, and at a span of 0, TIP II has no sensitivity. If the chemicals you wish to detect are at too low a concentration to cause much change in the LCD reading, then use a higher span setting. Conversely, lower the span setting if the LCD shows a "1" at the far left position and not other numerals. This indicates an off-scale concentration.
4. Turn the ring up to press against the underside of the SPAN control.
5. Clean air is, of course, a relative term. Outdoor air is often a suitable zero reference. Zero TIP II upwind from a spill site or a waste site. For indoor leak detection work, zero TIP II on outdoor air away from the suspected leak.
6. Turn the ZERO control clockwise to increase the reading or counter-clockwise to decrease it. By adjusting the LCD to read 0.00, any background chemicals in the air are cancelled out. If the reading is unstable you may have to use a lower span setting. Sampling in a windy location will also cause the reading to jump, so keep the inlet sheltered. If the chemical concentration in the air is fluctuating, then so will the output of

TIP II. Such a sample is unsuitable as a zero reference, try moving further from the chemical source.

You might find that the LCD never reads 0.00, no matter where you set the ZERO control. In this case, a coarse zero adjustment is needed. Set the ZERO control to 5, then turn the COARSE ZERO control reached through a hole at the back of the front bulkhead with a small slotted screwdriver. Remove the screwdriver when the LCD reads about 0. Now make any fine adjustments with the ZERO control.

7. Again, turn the locking ring counterclockwise until it presses against the ZERO knob.
8. Now you're ready to begin your investigation. As you move close to chemical sources, the LCD will register higher concentrations, allowing rapid source determination. A negative LCD reading indicates the sample has fewer total ionizables than the zero reference air. With a headset connected to TIP II, you can hear concentration changes as frequency changes, and you need not look at the LCD. This is especially useful in extended periods of work, where your eyes may become tired.
9. If you should, despite your best efforts, draw up some liquid into TIP II, the instrument may be permanently damaged if you don't quickly follow the instructions in Section 5 of the user's guide - "Maintenance".
10. Turn TIP II off when you are finished, or when the "LOBAT" sign appears at the top left of the LCD.

Appendix G-3

SITE SAFETY PLAN CONSENT AGREEMENT

**SITE SAFETY PLAN
CONSENT AGREEMENT**

I have reviewed the Sweet-Edwards/EMCON, Inc. Health and Safety Plan for the Chempro Pier 91 Company facility fieldwork. I understand its purpose and consent to adhere to its policies, procedures, and guidelines while an employee of Sweet-Edwards/EMCON, Inc. or its subcontractors.

Employee Signature

Date

Employee Signature

Date

Employee Signature

Date

Employee Signature

Date

Employee Signature

Date

Employee Signature

Date

PART H

COMMUNITY RELATIONS PLAN

1 INTRODUCTION

This section describes the proposed Community Relations Plan (CRP) to be conducted as part of the RCRA 3008 Consent Order for the Pier 91 facility operated by Chemical Processors, Inc. in Seattle, Washington. This plan was prepared according to guidelines in the Environmental Protection Agency's Superfund Community Relations Handbook, Interim Version, June 1988; and Guidance on Public Involvement in the RCRA Permitting Program, December 6, 1985. The CRP has been designed to assist in the overall effort to correct contamination at the Chemical Processors, Inc. (Chempro) facility at Pier 91, Port of Seattle, Washington.

1.1 Overview of the Community Relations Plan

Purpose

The CRP for the Pier 91 Chempro site is designed to identify and incorporate concerns from adjacent residents and business owners and/or operators into any proposed work plans for the site. These concerns will be addressed in the CRP and subsequent corrective actions.

Another purpose of the program is to inform individuals and groups in the area who have previously been unaware of any potential contamination at the site. These individuals include local residents and business owners who have previously been uninvolved with activities at the site. These individuals will be contacted and provided an opportunity to comment about concerns associated with the site investigation.

1.2 Capsule Site Description

Location

The Pier 91 Chempro facility is operated on Port of Seattle (POS) property at Pier 91 at 2001 West Garfield Street, Seattle, Washington. The site is permitted and zoned by the City of Seattle as General Industrial. The

Pier 91 facility is a 4-acre site. All land immediately adjacent to the facility is used for industrial and maritime purposes and is zoned General Industrial. Proximity to the nearest single or multi-family residences is about 1,300 feet from the Chempro Pier 91 site. The closest surface water body is Elliott Bay. Smith Cove and Smith Cove Waterway are approximately 1/4 mile from the site. Initial discussions with the Department of Ecology determined that there are no well logs for the area, indicating that the local groundwater is not used for drinking water.

Site Use

The Pier 91 facility provides for waste oil recovery and blending and for tank storage and treatment of dangerous wastes. Typical wastes processed at the site include oil and coolant emulsions, industrial wastewaters and industrial waste sludges.

The site was first used for industrial purposes in 1926 when the California Petroleum Company constructed the existing tank system. In 1941 the Navy acquired the site and used the facility as a fuel and lubricating facility until the early 1970s. In 1972 the Navy declared the property as surplus, turning the property over to the Port of Seattle, the current property owner. Chempro began operation at the site in 1971. A major portion of the site's tank system has been subleased to Pacific Northern Oil Company (PANOCO) since the early 1970s for use as a maritime boiler fuel oil depot.

Past practices at the site have resulted in releases of compounds to shallow soil and ground water. Detected compounds in shallow soils and/or ground water include benzene, ethylbenzene, toluene, xylene (BTEX), chlorinated organic compounds, and polyaromatic hydrocarbons (PAHs).

The Port of Seattle's Neighborhood Advisory Committee (NAC) has expressed concern about odors detected near the site.

Several soil and ground water investigations have been conducted at the Pier 91 facility. See Part A, Sections 3 and 4 for a complete list of previous studies and findings from previous studies.

2 COMMUNITY RELATIONS

2.1 Community Background

The character of the area adjacent to the Chempro Pier 91 facility is industrial. The single family residences in the area are located principally on hillside locations overlook the Pier 91 facility.

History of Community Involvement

A Chempro representative frequently attends the meetings of the POS NAC and occasionally gives presentations about Chempro activities and answers questions from other committee members. Chempro has attempted to maintain contact with the community and address concerns as they arise. Chempro has not received complaints or comments from local residents directly, only through the auspices of the NAC.

Key Community Concerns

Concerns identified to date include odors, potential for airborne transmission of contaminants, and the potential for off-site migration of contaminated ground water. Meetings with community members and individual interviews will be conducted to determine any other concerns. As additional concerns are identified, they will be conveyed to the technical team. Results of the community interviews and meetings will be summarized in a final CRP report.

2.2 Highlights of the Community Relations Program

The CRP will be conducted by Chempro staff. Chempro Public Affairs Manager, Kate Tate, will contact staff members at each of the businesses located within a 1/2-mile radius of the Pier 91 facility as well as operators of other major industrial land uses in the area. Chempro staff will prepare an informal questionnaire regarding potential concerns regarding this site, and will briefly summarize activities at the site to date. Chempro will meet

informally with community opinion leaders (see Appendix H-1) to discuss the CRP and obtain feedback on preferred approach and specific ideas for activities in the CRP. Based upon these suggestions, Chempro will implement the CRP.

A brief written summary of the site history and current activities will be mailed to each of the residences, business and community organizations located within a 1/2-mile radius of the site. The mailer will include a stamped, addressed response card which will allow the respondent to indicate if they have additional concerns and would like to be interviewed. Those respondents will be personally interviewed by Chempro staff.

A summary of the facility operation, including a description of potential environmental risks associated with the site, will be prepared and placed in an Information Repository at a site or sites determined to be advantageous by key community opinion leaders. Local citizens will be informed of the availability of this information summary in the previously-described mailing.

A community meeting will be held at the end of the site investigation, after the final Facility Investigation Report has been approved by EPA. The meeting will be advertised by mailings to individuals and businesses as well as by public notices on telephone poles and at other visible locations. This meeting will summarize the results of the investigation, and describe alternatives for future activities at the site. Comments will be received and summarized for use by the technical team.

A second community meeting will be held prior to selection of a recommended alternative for future activities at the site. The community will be informed of the recommended plan, and the methods of incorporating the comments/concerns raised in the first community meeting will be described. Comments regarding the recommended alternative will be discussed.

Upon selection of the recommended alternative, the community will be notified in a brief mailing.

2.3 Community Relations Activities and Timing

- Chempro meets with community opinion leaders during the first month following RFI Work Plan approval. The mailing list will be compiled during the second month following RFI Work Plan approval.

- Mailers will be mailed during the third month following RFI Work Plan approval.
- Community/business interviews will be conducted during the fourth and fifth month of the RFI Work Plan approval.
- The Information Repository will be available to the public in the fourth month after RFI Work Plan approval.
- The first community meeting will be held approximately six weeks after the EPA accepts the final report of the site evaluation, on a date specified by EPA.
- The date of the second community meeting will be set after future activities at the site have been determined and EPA has accepted the Corrective Measures Study.
- The CRP Task Report will be prepared within four weeks of completion of the final RFI Report.

Appendix H-1

**CONTACT LIST OF KEY COMMUNITY LEADERS
AND INTERESTED PARTIES**

-
- Elected Officials
 - Port of Seattle Commissioners
 - City of Seattle Council Members
 - King County Council Members
 - POS Neighborhood Advisory Committee Members and Chairman, Frank Gaffney
 - City/County/POS Planners
 - Queen Anne Community Council
 - Magnolia Community Council
 - Port Watch
 - Indian Tribes
 - Business Associations
 - Recreation/Environmental Groups
 - Schools, PTSAs
-

PART I

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